

# OutBack Power Systems

## *“Americas” and “Mobile”*

### *FX and VFX Inverter/Charger*

#### **Installation and Programming Manual**

Document Revision 7.2

**FX 2012T** - 2.0 kW / 12 VDC / 120 VAC / 60 Hz (*Sealed + Turbo / Americas*)

**FX 2524T** - 2.0 kW / 24 VDC / 120 VAC / 60 Hz (*Sealed + Turbo / Americas*)

**FX 3048T** - 2.5 kW / 48 VDC / 120 VAC / 60 Hz (*Sealed + Turbo / Americas*)

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**VFX 2812** - 2.8 kW / 12 VDC / 120 VAC / 60 Hz (*Ventilated / Americas*)

**VFX 3524** - 3.5 kW / 24 VDC / 120 VAC / 60 Hz (*Ventilated / Americas*)

**VFX 3648** - 3.6 kW / 48 VDC / 120 VAC / 60 Hz (*Ventilated / Americas*)

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**FX 2012MT** - 2.0 kW / 12 VDC / 120 VAC / 60 Hz (*Sealed + Turbo / Mobile*)

**FX 2524MT** - 2.0 kW / 24 VDC / 120 VAC / 60 Hz (*Sealed + Turbo / Mobile*)

**FX 2532MT** - 2.5 kW / 32 VDC / 120 VAC / 60 Hz (*Sealed + Turbo / Mobile*)

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**VFX 2812M** - 2.8 kW / 12 VDC / 120 VAC / 60 Hz (*Ventilated / Mobile*)

**VFX 3524M** - 3.5 kW / 24 VDC / 120 VAC / 60 Hz (*Ventilated / Mobile*)

**VFX 3232M** - 3.2 kW / 32 VDC / 120 VAC / 60 Hz (*Ventilated / Mobile*)

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**“T”** stands for **Turbo**

**“M”** stands for **Mobile**



*The “Sealed” version of the FX*



*The “Vented” version of the FX*

*The “Turbo Kit” that comes with the FX “T” series is shown on page 15*

*Please check our website at [www.outbackpower.com](http://www.outbackpower.com) for the latest product information*



**IMPORTANT SAFETY INSTRUCTIONS** ..... 5

**Installation Guidelines** ..... 5

**General Precautions** ..... 6

**Additional Notices** ..... 6

**Personal Precautions While Working with Batteries**..... 6

**RATINGS**..... 7

**MOUNTING** ..... 9

**COMPLETE OUTBACK INTEGRATED SYSTEMS** ..... 10

**AC WIRING CONNECTIONS**..... 11

**INDICATORS & CONTROL WIRING** ..... 12

**DC BATTERY TERMINALS** ..... 13

**EQUIPMENT GROUND TERMINALS** ..... 13

**BATTERY TERMINAL COVERS** ..... 13

**FX ACCESSORIES**..... 14

**TURBO KIT INFORMATION**..... 15

**HUB COMMUNICATION MANAGER** ..... 16

**FX SYSTEM CONFIGURATIONS** ..... 17

**Single FX System** ..... 17

**Series or Series/Parallel Dual FX System**..... 18

**Paralleled Dual FX System** ..... 19

**Series/Parallel Quad FX System** ..... 20

**Paralleled Quad FX System**..... 21

**3-Phase FX System** ..... 22

**START-UP & OPERATION**..... 23

**BATTERY CHARGING INFORMATION**..... 24

**BATTERY CHARGING SETPOINTS** ..... 24

**BATTERY EQUALIZATION**..... 24

**RTS – THE REMOTE TEMPERATURE SENSOR**..... 24

**BATTERY CHARGING SEQUENCE**..... 24

**BATTERY CHARGING CONSTRAINTS**..... 25

**STACKING INFORMATION** ..... 26

**Classic, OutBack, and 3-Phase Stacking Methods** ..... 26

**X-240 AUTOTRANSFORMER CAPACITY** ..... 26

**STACKING INSTRUCTIONS** ..... 27

**Stacking Procedure** ..... 27

**STACK PHASE** ..... 27

**POWER SAVE LEVEL MASTER ADJUST ONLY** ..... 28

POWER SAVE LEVEL <i>SLAVE</i> ADJUST ONLY.....	28
<b>System Examples .....</b>	<b>28</b>
DUAL-STACKED SYSTEM USING “CLASSIC” STACKING .....	28
STACKED SYSTEM USING OUTBACK’S “PARALLEL” STACKING.....	28
STACKED SYSTEM USING OUTBACK’S “SERIES / PARALLEL” STACKING .....	29
3-PHASE STACKED SYSTEM (3 FX’s ONLY).....	30
<b>AUTOMATIC GENERATOR START INSTRUCTIONS .....</b>	<b>31</b>
<b>MOBILE FX INFORMATION .....</b>	<b>32</b>
<b>General.....</b>	<b>32</b>
GROUND SWITCHING.....	32
STACKING MOBILE FX INVERTER/CHARGERS.....	32
MAXIMUM AC INPUT CURRENT .....	32
<b>Dual Input Transfer Switch Setup.....</b>	<b>33</b>
<b>MATE - SYSTEM CONTROLLER AND DISPLAY.....</b>	<b>34</b>
<b>Inverter Control .....</b>	<b>38</b>
<b>AC Input Control .....</b>	<b>39</b>
<b>MATE - MENU MAP .....</b>	<b>40</b>
<b>MATE SCREENS .....</b>	<b>42</b>
<b>Summary Screen .....</b>	<b>42</b>
EXAMPLES.....	42
<b>Status Screens .....</b>	<b>43</b>
MODES MENU .....	43
METER MENU .....	44
BATTERY MENU.....	45
ERROR MENU.....	46
WARNING MENU.....	47
DISCONNECT MENU .....	48
SELL MENU.....	49
<b>Setup Screens .....</b>	<b>50</b>
SEARCH MENU .....	50
INPUT MENU.....	51
<b>Advanced Screens.....</b>	<b>52</b>
INVERTER MENU .....	53
CHARGER MENU.....	54
GRID MENU.....	55
GENERATOR MENU .....	56
AUXILIARY MENU .....	57
STACKING MENU.....	59
SELL MENU.....	60
CALIBRATION MENU .....	61
<b>WIRE SIZES .....</b>	<b>62</b>
<b>WARRANTY .....</b>	<b>63</b>
<b>REGISTRATION.....</b>	<b>65</b>
<b>Extended Warranty Application.....</b>	<b>65</b>

## Installation Guidelines

This manual contains important instructions for the OutBack FX series inverter/charger system with the software which allows classic (two FX's in series), parallel and series/parallel stacking of two to ten FX's for higher power and/or higher voltage systems.

- 1 **All of the AC wiring to the AC terminals is to be torqued to 30 inch-pounds (equivalent to 2.5 foot-pounds or 3.4 Nm).** Wiring to these terminals must meet requirements of the National Electric Code (NEC). The terminals will accept up to 6AWG. Use copper conductors only with insulation rated for 75° C. See the AC WIRING CONNECTIONS section of this manual for more information.
- 2 **Torque the DC connections to 60 inch-pounds (equivalent to 5 foot-pounds or 6.8 Nm).** Cables to these terminals must use a crimp on type ring terminal or compression type lug. Cable must meet the requirements of the National Electrical Code. Use of large gauge cables (2/0 or 4/0 AWG) or larger is advisable to reduce losses and ensure high performance of the FX. Cables of too small a gauge can result in poor performance and even damage the FX. Keep the cables together as much as possible and ensure that both cables pass through the same knockout and conduit fittings and to allow the inductive currents to cancel.
- 3 For equipment grounding hook up, see the system configuration sections in this manual. Non-mobile ("M") FXs are intended to be installed as part of a permanently grounded electrical system per the NEC. Mobile FXs include integral "Ground-switching" mechanisms. Please refer to the MOBILE FX INFORMATION section of this manual for proper grounding instructions.
- 4 AC overcurrent protection for all connections must be provided by others as part of the installation.
- 5 DC battery circuit overcurrent protection must be provided by others as part of the installation. OutBack offers 100, 175 and 250 amp DC breakers (part number OBDC-XXX) which can be used with the FX. For "Mobile" installations, OutBack includes a stud mounted fuse which can be connected directly to the positive DC terminal of the FX – it is available in 100, 175 and 250 amp sizes (part number SMF-XXX). The stud mounted fuses require a 10mm hole in the battery terminal lug. US lugs are typically 3/8" diameter. Light filing may be required to insure proper fit of the nut shoulder into the lug hole.



- 6 The equipment ground on the inverter is marked with this symbol:



- 7 This inverter has a single phase output. It is marked with this symbol:



- 8 This inverter puts out a sine wave waveform. It is marked with this symbol:

- 9 **CAUTION:** To reduce the risk of fire, connect only to a circuit provided with 60 amp maximum branch-circuit overcurrent protection in accordance with the National Electrical Code, ANSI/NFPA 70.
- 10 **WARNING:** To reduce the risk of fire, do not connect a single FX to both hot legs of a 120/240 VAC AC load center having multi wire (common neutral) branch circuits connected. Use two FX's wired in a series configuration or the addition of an X-240 autotransformer if you are connecting to a 120/240 VAC multi wire system.
- 11 **IMPORTANT:** Always install the battery terminal covers, even in systems that include the DCC (DC Compartment Cover).

## General Precautions

1. Before using the FX, read all instructions and cautionary markings on (1) the FX, (2) the batteries and (3) all appropriate sections of this installation and operation manual.
2. **CAUTION** - To reduce risk of injury, charge only deep-cycle lead acid, lead antimony, lead calcium, gel cell or absorbed glass mat type rechargeable batteries. Other types of batteries may burst, causing personal injury and damage.
3. The FX is approved for indoor mounting only and can be mounted in any position.
4. Do not disassemble the FX. Refer servicing to a qualified service center when service or repair is required. Incorrect re-assembly may result in a risk of electric shock or fire.
5. To reduce risk of electric shock, disconnect all wiring before attempting any maintenance or cleaning. Turning off the FX may not reduce this risk. Solar modules may produce hazardous voltages when exposed to light - cover them with opaque material before servicing any connected equipment.
6. **WARNING - WORKING IN THE VICINITY OF A LEAD ACID BATTERY IS DANGEROUS. BATTERIES GENERATE EXPLOSIVE GASES DURING NORMAL OPERATION.** Provide ventilation to outdoors from the battery compartment. The battery enclosure should be designed to prevent accumulation and concentration of hydrogen gas in "pockets" at the top of the enclosure. Vent the battery compartment from the highest point. A sloped lid can also be used to direct the flow of hydrogen to the vent opening at the highest possible location.
7. NEVER charge a frozen battery.
8. No terminals or lugs are required for hook-up of the AC wiring. AC wiring must be copper wire and rated for 75°C or higher. Battery cables must be rated for 75°C or higher. Crimped and sealed copper ring terminal lugs with a 5/16" hole should be used to connect the battery cables to the DC terminals of this FX. If using the stud mounted fuse, the positive lug must have a hole of at least 10mm. Soldered cable lugs are also acceptable.
9. **Torque all AC wiring connections to 30 inch-pounds (equivalent to 2.5 foot-pounds or 3.4 Nm).**
10. **Torque the DC connections to 60 inch-pounds (equivalent to 5 foot-pounds or 6.8 Nm).**
11. Be careful with tools to reduce the risk of dropping metal objects onto batteries. It may short-circuit the batteries or other electrical parts resulting in fire or explosion.

## Additional Notices

1. For instructions on mounting, see the MOUNTING section of this manual.
2. For battery installation and maintenance: read the battery manufacturer's instructions prior to installation and operation.
3. All installations must comply with local and national electrical codes and standards.
4. **GROUNDING INSTRUCTIONS** – The FX should be connected to a grounded, permanent wiring system. For all installations, the negative battery conductor should be bonded to the grounding system at one (and only one) point in the system. All installations should comply with national and local codes and ordinances. **Do not positive ground the FX !**

## Personal Precautions While Working with Batteries

1. Someone should be within range of your voice to come to your aid.
2. Have plenty of fresh water and soap nearby in case battery acid contacts skin, clothing, or eyes.
3. Wear complete eye protection. Avoid touching eyes while working near batteries. Wash your hands with soap and warm water when done.
4. If battery acid contacts skin or clothing, wash immediately with soap and water. If acid enters eye, immediately flood eye with running cool water for at least 15 minutes and get medical attention immediately.
5. Baking soda neutralizes lead acid battery electrolyte. Keep a supply on hand in the area of the batteries.
6. **NEVER** smoke or allow a spark or flame in vicinity of a battery or generator.
7. Be extra cautious to reduce the risk of dropping a metal tool onto batteries. It could short-circuit the batteries or other electrical parts that may result in fire or explosion.
8. Remove personal metal items such as rings, bracelets, necklaces, and watches when working with a battery. A battery can produce a short circuit current high enough to weld a ring or the like to metal, causing severe burns.
9. If a remote or automatic generator start system is used, disable the automatic starting circuit and/or disconnect the generator from its starting battery while servicing it to prevent starting while servicing.

**ATTENTION: All “FX” inverter/chargers are ETL listed to UL 1741.  
 All “Mobile” FX inverter/chargers are ETL listed to UL 458.  
 ETL is a Nationally Recognized Testing Laboratory (NRTL).**

**NOMINAL SYSTEM AC VOLTAGE:**

This is the AC output voltage produced by an FX system. Each FX produces 120 VAC but multiple FXs can be configured in parallel, series or 3-phase to produce different voltages between their AC output connections.

<b>Single Phase</b>	120 VAC at 60 Hz (VAC = volts AC, Hz = hertz)
<b>Series Stacked</b>	120 VAC at 60 Hz per AC output leg / 240VAC at 60Hz between the AC output legs
<b>Parallel Stacked</b>	120 VAC at 60 Hz on one AC output leg
<b>Three Phase Stacked</b>	120 VAC at 60 Hz per AC output leg / 208 VAC at 60 Hz between AC output legs (Y-connected)

**RECOMMENDED DC VOLTAGE RANGE:**

This is the DC battery voltage range to be used for operating the FX. The last two digits in the model number designate the nominal DC voltage. Example: FX2024MT – 24V DC Voltage. The recommended battery voltage range is as follows.

<b>12V Systems</b>	11 – 16 VDC (VDC = volts DC)
<b>24V Systems</b>	22 – 32 VDC
<b>32V Systems</b>	29 – 43 VDC
<b>48V Systems</b>	44 – 64 VDC

**MAXIMUM DC INPUT CURRENT:**

This is the maximum DC current that the FX will draw from the battery when starting very large AC loads. It is not used for sizing the DC disconnect or selecting DC cable gauge. It is used to select the minimum reasonable battery capacity.

<b>12V FXs</b>	600 ADC per FX (ADC = amps DC)
<b>24V FXs</b>	300 ADC per FX
<b>32V FXs</b>	225 ADC per FX
<b>48V FXs</b>	150 ADC per FX

**RATED DC INPUT CURRENT:**

This is the maximum continuous DC current that the FX will draw from the batteries when inverting.

<b>FX2012(M)T</b>	190 ADC (ADC = amps DC)
<b>FX2524(M)T</b>	120 ADC
<b>FX2532(M)T</b>	90 ADC
<b>FX3048T</b>	70 ADC
<b>VFX2812(M)</b>	265 ADC
<b>VFX3524(M)</b>	170 ADC
<b>VFX3232(M)</b>	115 ADC
<b>VFX3648</b>	85 ADC

**AC INPUT OPERATING VOLTAGE RANGE:**

This is the recommended AC input voltage range to be supplied to the FX. Voltages outside of this range may damage AC loads connected to the FXs AC output terminals. This is only a recommendation, neither the FX’s defaults nor the set point limits.

<b>All FXs</b>	90 – 150 VAC (VAC = volts AC)	<b>Defaults = 108 – 140 VAC</b>
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**MAXIMUM AC INPUT CURRENT:**

An AC input source connected to the FX supplies power for two separate internal AC circuits – the AC transfer switch and the battery charger. The AC transfer switch transfers the AC input power through the FX to the AC loads connected to the AC output of the FX. The FX’s battery charger will “back off” when the combined amperage of the AC loads and the battery charger exceeds the “AC Input Limit” (default of 28 AAC for Mobile FXs, 48 AAC for non-Mobile FXs). This “AC Input Limit” can be adjusted so as not to overload a generator or trip a breaker that is connected to the AC input of the FX. If your generator cannot continuously produce the “AC Input Limit” or you are connecting to an AC input source that has a breaker that is rated for less than the “AC Input Limit”, please refer to the ADVANCED section to change this setting.

<b>All “Mobile” FXs</b>	30 AAC per FX (AAC = amps AC)
<b>All Other FXs</b>	60 AAC per FX (AAC = amps AC)

## MAXIMUM CURRENT FOR BATTERY CHARGER:

The FX uses AC current from the AC input source to charge the battery. Due to heat constraints, the FX limits this amount of current. The maximum and default values for this setting are shown below. Please refer to the programming section to adjust this setting. The battery charger has an efficiency of about 90%. There are other factors like cable losses that may reduce this efficiency. The maximum DC current that can be produced is also shown below. These maximum DC currents can only be attained in the "Bulk" charging stage.

<b>FX2012(M)T</b>	AC Max = 12 AAC (Default = 10 AAC)	DC Max = 100 ADC
<b>FX2524(M)T</b>	AC Max = 14 AAC (Default = 12 AAC)	DC Max = 55 ADC
<b>FX2532(M)T</b>	AC Max = 14 AAC (Default = 12 AAC)	DC Max = 40 ADC
<b>FX3048T</b>	AC Max = 14 AAC (Default = 12 AAC)	DC Max = 35 ADC
<b>VFX2812(M)</b>	AC Max = 16 AAC (Default = 14 AAC)	DC Max = 125 ADC
<b>VFX3524(M)</b>	AC Max = 20 AAC (Default = 18 AAC)	DC Max = 85 ADC
<b>VFX3232(M)</b>	AC Max = 20 AAC (Default = 18 AAC)	DC Max = 60 ADC
<b>VFX3648</b>	AC Max = 20 AAC (Default = 18 AAC)	DC Max = 45 ADC

## AC INPUT FREQUENCY RANGE:

This is the AC input source's frequency range of which the FX will accept and stay connected. If the AC input source is out of this range, the FX will not connect or stay connected.

**All FXs** 56 - 64 Hz

## MAXIMUM AC OUTPUT CURRENT:

This is the amount of AC "Surge" current that the FX will supply. This amount of surge can only be supplied for a split second. After this split second the FX lowers this surge limit. Depending on the size of the surge, the FX can be overloaded for a minimum time of 5 seconds to a maximum time of 30 minutes. When passing an AC source through the FX via the AC transfer switch, the maximum AC output fault current will be determined by the AC source.

**All 12 VDC FXs** 40 AAC per FX for 1 millisecond

**All Other FXs** 50 AAC per FX for 1 millisecond

## MAXIMUM CONTINUOUS OUTPUT POWER:

Each FX has a maximum continuous output power it can deliver. This maximum continuous output power is hidden in the model number of the FX. For instance, an FX2012MT has a maximum continuous output power of 2000VA (volt-amps). The last two numbers (12 in this case) can be changed to 0's because they refer to the battery voltage.

<b>FX2012(M)T</b>	2000 VA (VA = volt-amps)
<b>FX2524(M)T</b>	2500 VA
<b>FX2532(M)T</b>	2500 VA
<b>FX3048T</b>	3000 VA
<b>VFX2812(M)</b>	2800 VA
<b>VFX3524(M)</b>	3500 VA
<b>VFX3232(M)</b>	3200 VA
<b>VFX3648</b>	3600 VA

## MAXIMUM OVERCURRENT PROTECTION AMPACITY:

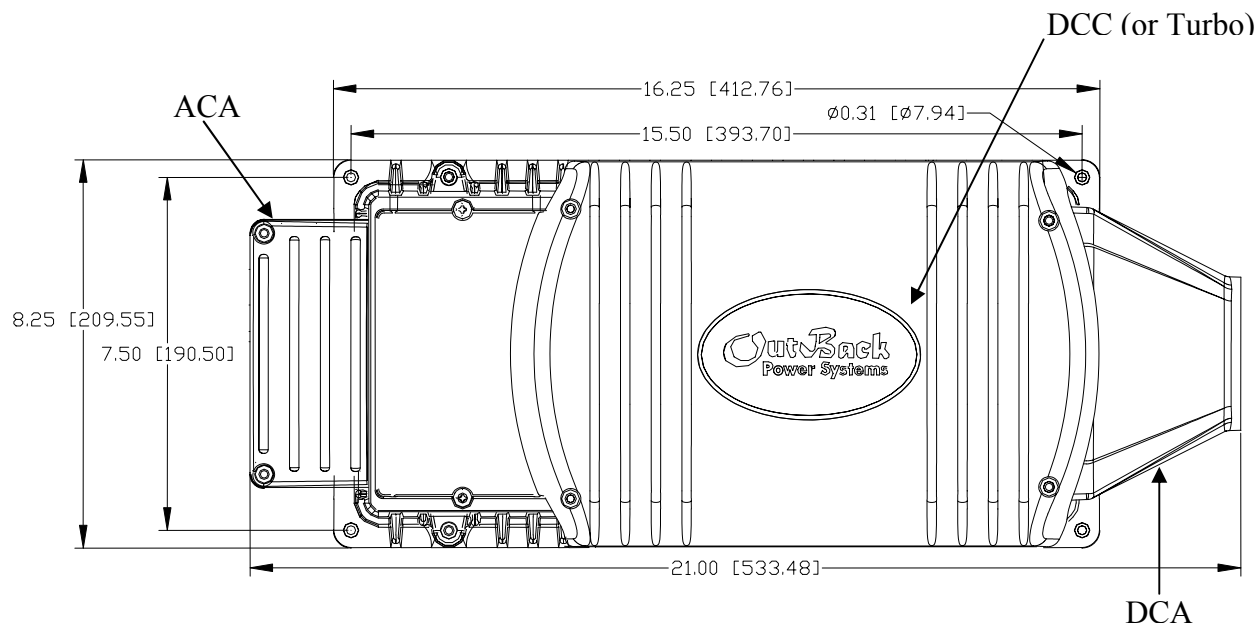
This rating specifies the proper overcurrent protection ampacity. OBDC are panel mount circuit breakers. SMF are DC terminal mounted fuses and should always be used in conjunction with a disconnect mechanism. FX's used in home installations should use properly sized DC circuit breakers. An OBDC circuit breaker includes both overcurrent protection and disconnection capability. SMFs are used primarily for marine installations where only DC overcurrent protection is required. SMFs are included with all "Mobile" FXs.

<u>MODEL</u>	<u>AMPACITY</u>	<u>DC BREAKER</u>	<u>DC FUSE</u>
<b>FX2012(M)T</b>	250 amps	OBDC-250	SMF-250 (Mobile Only)
<b>FX2524(M)T</b>	175 amps	OBDC-175	SMF-175 (Mobile Only)
<b>FX2532(M)T</b>	175 amps	OBDC-175	SMF-175 (Mobile Only)
<b>FX3048T</b>	100 amps	OBDC-100	Not Recommended
<b>VFX2812(M)</b>	250 amps	OBDC-250	SMF-250 (Mobile Only)
<b>VFX3524(M)</b>	250 amps	OBDC-250	SMF-250 (Mobile Only)
<b>VFX3232(M)</b>	175 amps	OBDC-175	SMF-175 (Mobile Only)
<b>VFX3648</b>	175 amps	OBDC-175	Not Recommended



All FX's can be mounted in any position. Better performance will be achieved if it is mounted in a location which allows for air to circulate around the exterior of the casting. Locating the FX in a cool location will ensure the highest efficiency and power capacity.

The following drawings provide the mounting and overall dimensions of the FX with the DCC, ACA and DCA attached. All VFXs come with the DCC and all FX "T"s come with the Turbo. The ACA and the DCA must be ordered separately. The first dimension is inches and the second value in parenthesis is the metric value in millimeters.

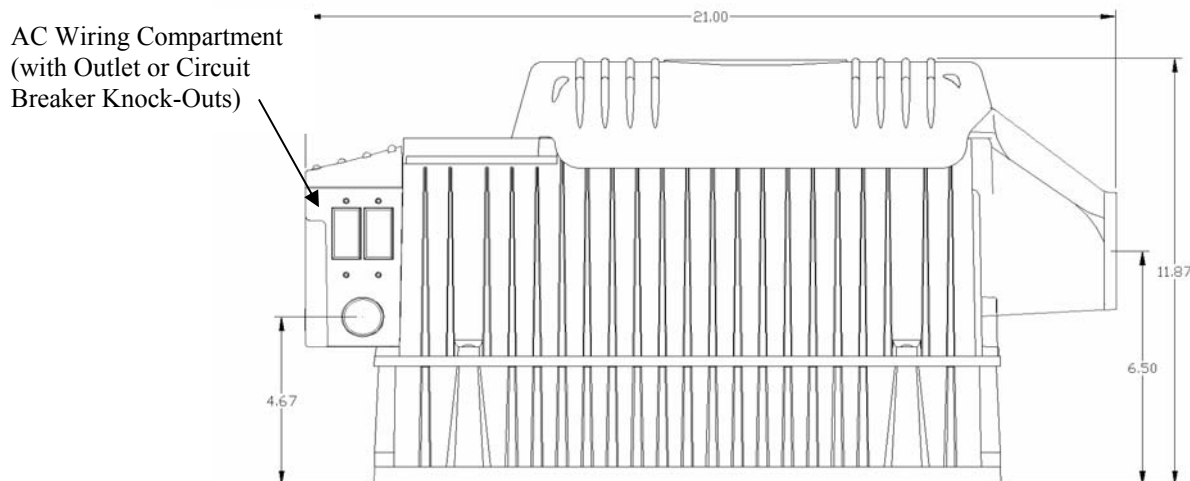


Depth out from Wall / Height up from Shelf: 11.87 inches (301 mm) / 12.87 INCHES (327mm) with Turbo installed

For installations where the FX may be exposed to water spray a sealed FX must be used. A sealed FX that may be exposed to water spray should be mounted either with the base down (shelf mounting) or with the AC wiring compartment facing down (wall mounting). This will minimize the entry of water into the AC wiring compartment. If mounted with the base down, water cannot be allowed to accumulate around the FX's base. There is a drainage system on the base of the FX to dispel condensation. If submerged, water can enter this drain and cause failure.

The ACA can be used to connect the FX to the PS2AC, PS4AC or 2" conduit. The side of the ACA can be used to add an AC outlet and one or two of OutBack's AC rated OBDC circuit breakers (up to 70 amps max). When these items are added to the FX, it should only be used in an area that is protected from rain.

The DCA can be used to connect the FX to the PS2DC, PS4DC or 2" conduit.



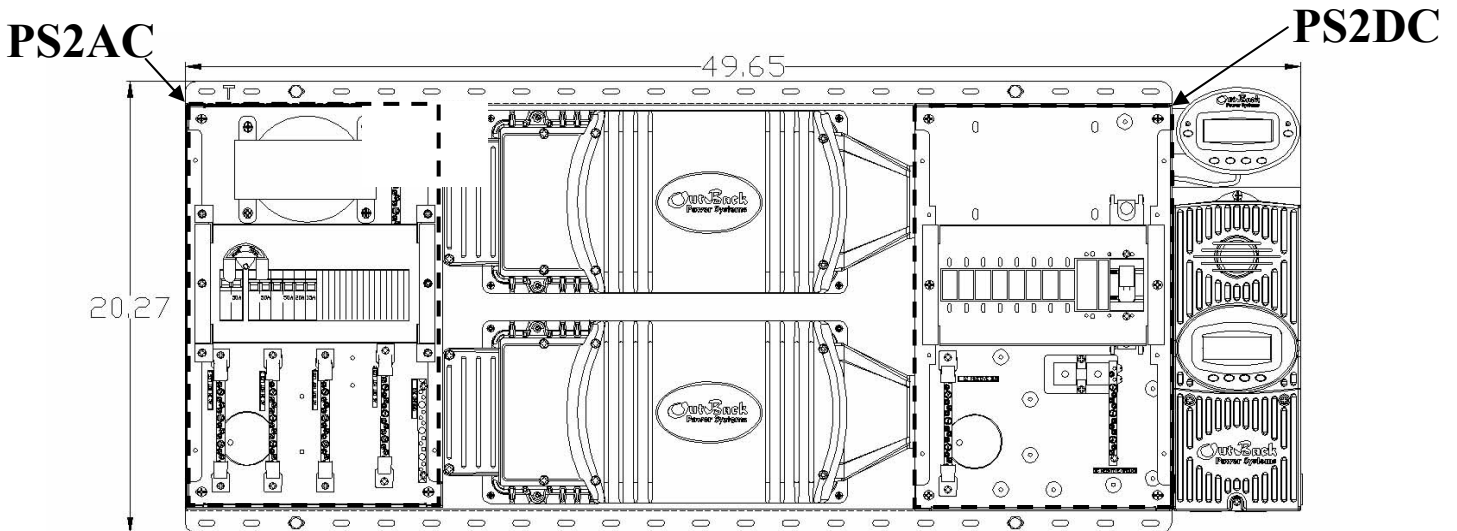
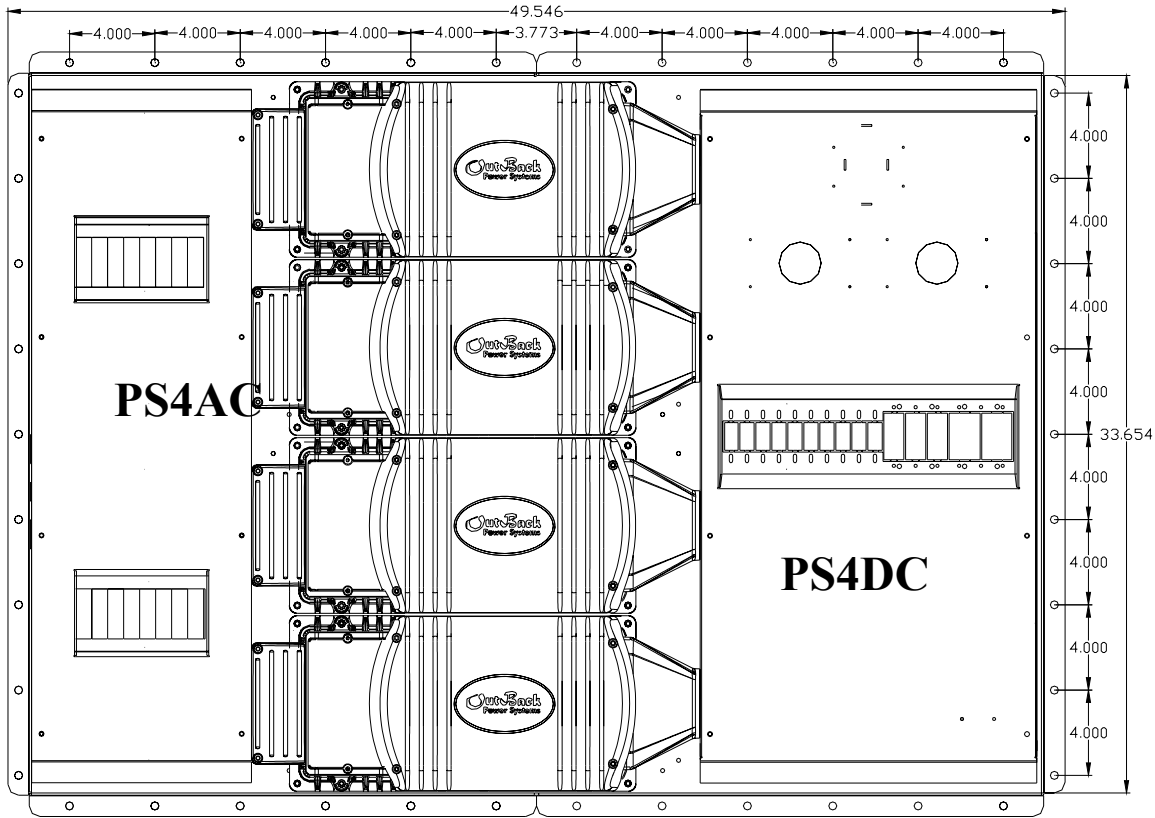
Side view of FX with FXA kit attached. The Turbo Kit adds 1" (25mm) additional height to achieve a total height of 12.87" (327mm)

# COMPLETE OUTBACK INTEGRATED SYSTEMS

Shown below are complete systems of OutBack FX's for indoor installations. The system with four FX's is shown mounted to the OutBack **PS4MP** (Power System 4 Mounting Plate where the "4" in refers to the maximum number of FX's that will fit). The PS4MP comes with six 1x20mm thread forming screws for attaching FX's and breaker boxes. The use of an external toothed star washer (provided) is required on one screw on each piece of equipment in order to bite through the powder coating and ensure grounding of all metal components. The system with two FX's is shown mounted to the smaller **PS2MP** power system mounting plate.

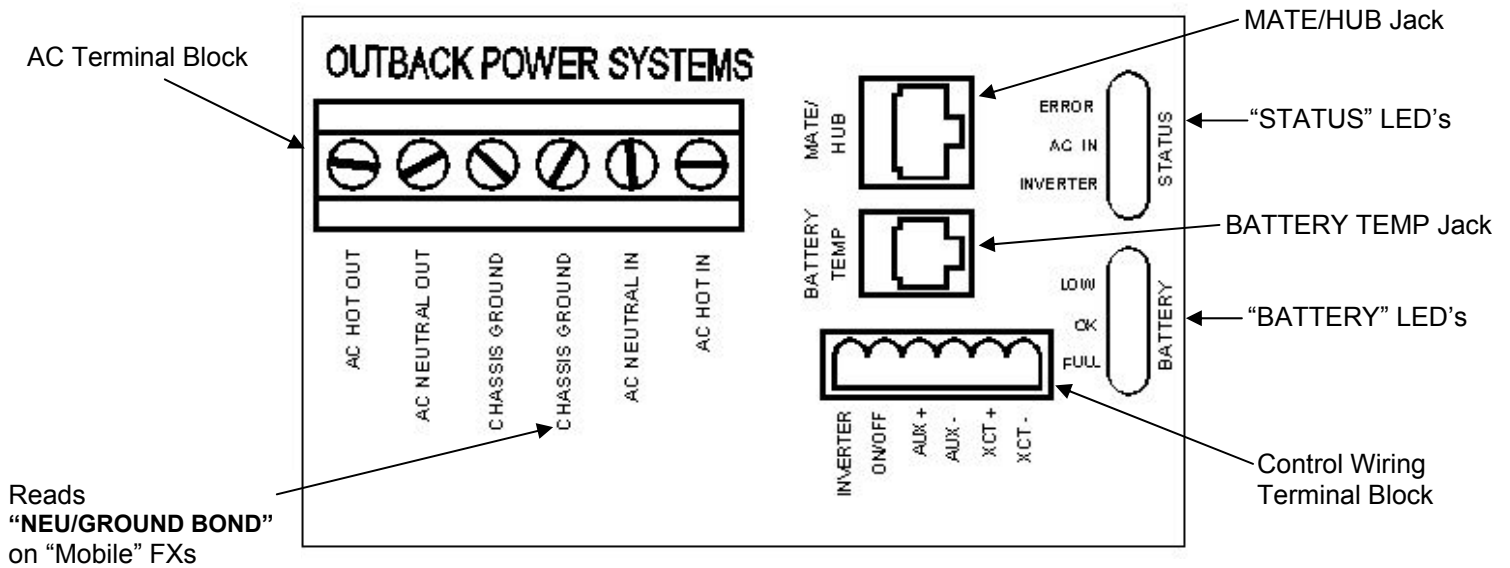
The mounting plate will typically need to be bolted to the studs in a wall using at least four 1/4" or 5/16" lag bolts 2" long. In addition to the mounting plate, these installations are also shown with an OutBack PS4DC or PS2DC (DC breaker box), PS4AC or PS2AC (AC breaker box), DCAs (DC Conduit Adapter), DCCs (DC Compartment Cover), and ACAs (AC Compartment Adapter). When two or more FX's are installed in close proximity such as in this installation, it may be useful to install one or more **DC-12 Fan Kits** inside the PS4DC or PS2DC (only one will fit) that will pressurize this enclosure – forcing air up through the DC Manifold and down over the external fins of the FXs. This will improve the battery charging performance by reducing the possibility of the FX's limiting charging due to reaching their maximum allowed temperatures. The AUX output of the FX can be used to power the DC-12 Fan.

These components are designed to complete the installation to NEC code while offering flexibility for future expansion.



The FX system and the other OutBack balance of system components are designed to make it easy to meet both local and National Electrical Codes (NEC) installation requirements. If you are not familiar with the NEC, you should have the equipment installed by a qualified renewable energy equipment electrician. Contact your dealer for information on qualified electricians. All wiring methods are to be made in accordance with the National Electrical Code, ANSI/NFPA 70.

The FX includes an AC wiring compartment with both a removable cover and AC conduit plate. Depending on the type of installation, the AC conduit plate may or may not be used.



The AC terminal block is designed to accept up to 6 AWG (13.3mm<sup>2</sup>) wires. A typical installation will use THHN type wire. 6 AWG (13.3mm<sup>2</sup>) wire is required in order to handle the 60 amp capacity of the non-Mobile FX's AC transfer switch. 10 AWG (5.3 mm<sup>2</sup>) wire or larger is required in order to handle the 30 amp capacity of the Mobile FX's AC transfer switch. All AC wiring connected to the AC terminal block must be rated for at least 75° C. Torque all of the set screws on the AC terminal block to 30 inch-pounds (equivalent to 2.5 foot-pounds or 3.4 Nm).

For a **non-Mobile FX** the AC hot input and hot output conductors should be supplied through 60 amp maximum AC branch rated circuit breakers. The AC hot input conductor should be connected to the AC HOT IN terminal and the AC HOT OUT terminal, respectively. The AC neutral input and AC neutral output conductors may be connected to the AC NEUTRAL IN and AC NEUTRAL OUT terminals or a common Neutral bus. The AC NEUTRAL OUT terminal is common with the AC NEUTRAL IN terminal within the non-Mobile FX and only one AC neutral connection is required to be connected to the FX if a separate AC neutral bus is installed. The ground wires of the AC input and the AC output may be connected to the two CHASSIS GROUND terminals or a common Ground bus. The two CHASSIS GROUND terminals are common within the non-Mobile FX so only one of them needs to be connected if a common Ground bus is installed in the system.

For a **Mobile FX** the AC hot input and hot output conductors should be supplied through 30 amp maximum AC branch rated circuit breakers. The AC hot input conductor should be connected to the AC HOT IN terminal and the AC HOT OUT terminal, respectively. The AC neutral input conductor **must** be connected to the Mobile FX's AC NEUTRAL IN terminal. The AC neutral output conductor **must** be connected to the Mobile FX's AC NEUTRAL OUT terminal. These two neutral terminals are not always connected within the Mobile FX and are necessary for the proper functioning and protection of the Mobile FX's ground-switching system. Connect the ground conductors of the AC input and AC output to the CHASSIS GROUND terminal of the Mobile FX. If there is only one Mobile FX in the system, leave the copper bus (provided) installed between the CHASSIS GROUND and NEU/GROUND BOND terminals. If there is more than one Mobile FX in the system, remove the copper bus from every SLAVE FX.

Many installations will use the AC-IOB input/output bypass breaker assembly mounted in the PS2AC or PS4AC. This bypass assembly allows the user to completely bypass the FX system for servicing or replacement. In "Normal" mode, the FXs AC hot outputs are connected through the AC-IOB's output breakers to the load bank. In "Bypass" mode, the AC source (generator or grid) is connected through the AC-IOB's bypass breakers to the load bank. In addition to the AC-IOB input/output bypass assembly, each FX has a separate AC input breaker. When in "Bypass" mode these AC input breakers should be turned off to ensure no AC power is connected to the FXs. After the FX has been powered down through the DC breaker, it can then be removed for servicing or replacement without loss of AC power to the AC loads of the system.

**NOTE:** Non-Mobile FXs need only bypass the AC input hot conductors. Mobile FXs need to bypass both the AC input hot and AC input neutral conductors.

## INDICATORS & CONTROL WIRING

The AC wiring compartment also encloses the following items; a 6-port terminal block, an RJ-11 jack, an RJ-45 jack, a set of three "Battery" LEDs and a set of three "Status" LEDs. The 6-port terminal block contains ports for Inverter & On/Off, AUX + & AUX -, and XCT + & XCT -. The RJ-11 "Battery Temp" jack accepts only OutBack's "RTS" battery temperature sensor. Non-OutBack sensors may fit, but if their thermister value is not identical to the RTS's, your battery bank could be destroyed. The RJ-45 "MATE/HUB" jack accepts the CAT-5 cable that is included with the MATE and the HUB. The "Battery" LEDs give a quick indication of the battery voltage. The "Status" LEDs give a quick indication of whether the FX is inverting, has AC input power, or if an Error has occurred.

The "Battery" LEDs operate at the following voltage levels:

LED Color	Nominal Battery Voltage		
	12 VDC	24 VDC	48 VDC
Green	12.5 or higher	25.0 or higher	50.0 or higher
Yellow	11.5 to 12.5	23.0 to 25.0	46.0 to 50.0
Red	11.5 or lower	23.0 or lower	46.0 or lower

The "Status" LEDs operate under the following conditions:

LED Color	LED Action	LED Indicates
Green	Solid GREEN	Inverter ON
	Flashing GREEN	Search Mode or Slave Power Save Mode
	Off	Inverter OFF
Yellow	Solid YELLOW	AC Source is connected
	Flashing YELLOW	AC Input Live – Waiting to connect to the FX
	Off	No AC Input Present
Red	Solid RED	Error – An Error Message will be automatically displayed on the MATE
	Flashing RED	Warning – A non-critical fault happened to the FX. The MATE can access this info.

### INVERTER ON/OFF

The left two terminals of the 6-port terminal block marked **INVERTER** and **ON/OFF** can be used to control the inverter's output. Connecting the two terminals through a switch will allow control of the inverter output if a MATE is not available. A small jumper wire is pre-installed into these two ports of the terminal block and must be removed in order to add the external switch. If the FX's AC output is off, check that the jumper wire is present and well connected. An installed switch overrides the control provided by the OutBack MATE. If the switch is set to OFF, the MATE will not be able to turn ON the inverter. The switch cannot put the FX into Search mode.

### AUXILIARY OUTPUT (AUX + / AUX -)

The Auxiliary output system uses the AUX + and AUX - terminals and is able to be programmed through the MATE to do a variety of tasks. The default use for these terminals is to drive one 12-volt fan for external cooling. The power available at these terminals is 12 VDC at 1.0 amps (12 watts) maximum. These terminals should not be connected to any type of DC load which has a high inrush current requirement. The FX includes internal electronic overcurrent protection for this 12 VDC output circuit which auto resets if it is short circuited. No additional fuses are required. Use the OutBack FX Turbo Kit or DC12-FAN for cooling. For automatic or advanced generator start functions, the Auxiliary Output can drive a 12V automotive relay for the 2-wire starting circuitry of a generator. OutBack Power Systems does not support 3-wire start generators; however, a 3-wire to 2-wire conversion kit is available from other sources.

### XCT + / XCT -

These terminals are not operational at this time.

### BATTERY TEMP {REMOTE TEMPERATURE SENSOR (RTS)}

The OutBack FX has a 4 conductor "phone" RJ-11 modular jack located in the AC compartment for the connection of an optional external battery temperature sensor, the **RTS** (sold separately), that allows for automatic adjustment of the battery charging process based on the temperature of the battery. Battery manufacturers provide recommended charge voltages based on temperatures of 25°C / 77°F. With the RTS attached, the FX adjusts the battery voltage 0.03 volts per degree Celsius for every 12-volts of battery present. When a HUB is used, the RTS must be plugged into the Master FX which must be plugged into port 1 of the HUB. If this is the case, only one RTS is required for all devices plugged into the HUB. The RTS should be stuck to the side of a battery below the electrolyte level so it can measure the temperature of the batteries. The wire from the RTS can be folded and routed underneath the transparent gray plastic lexan cover of the AC wiring compartment to allow connection to the battery. There is a small indentation in the aluminum casting between the battery terminals to allow for the wire to pass without affecting the sealing of the covers. When running additional wires under the smoked lexan cover, it may be required to snip some lexan away to allow for wire routing. The lexan will not crack when cutting or filing. **IMPORTANT:** Do not connect a different brand of battery temp sensor. It may cause battery failure!!!

### MATE / HUB

The 8 conductor "Ethernet" RJ-45 modular jack allows direct connection of a MATE system controller and display to the FX using standard CAT-5 type cabling. If multiple FX's or a FX and a MX charge controller are both in the system, an OutBack HUB communication manager is connected to this RJ-45 jack for stacking of the FX's and for efficient system performance. The HUB acts similarly to a computer hub to combine the communication signals of the devices together into a networked system. OutBack offers two different HUB products at this time. The **HUB-4** accepts up to four OutBack products and one MATE. The **HUB-10** connects up to ten OutBack products and one MATE. **NOTE:** Although the HUB has 2 ports for MATEs, only the 1<sup>st</sup> port is operational.

## DC BATTERY TERMINALS

The DC terminals are made from solid brass with a stainless steel threaded stud. The threads are M8 x 1.25. The black terminal is negative and the red terminal is positive. **DO NOT PUT ANY WASHERS BETWEEN THE TERMINAL MOUNTING SURFACE AND THE ACTUAL BATTERY CABLE LUG.** Place the lug, washers and nut in the following order: Lug, Flat Washer, Lock Washer, Nut. **TORQUE TO 60 INCH-POUNDS (5 FOOT POUNDS) MAXIMUM (6.77 NM).** Mobile FXs come with a fuse for protection of the battery cables connected to the FX. If used, the fuse must be mounted to the positive terminal (red). The hole of the battery cable lugs must be at least 10mm to properly fit the fuse. If using a 3/8" hole, file this down to produce a 10mm hole. Place the lug, fuse and fuse nut on the terminal in the following order: Fuse, Lug, Fuse Nut. **TORQUE THE FUSE NUT TO 60 INCH-POUNDS (5 FOOT POUNDS) MAXIMUM (6.77 NM).** Too much torque on the fuse nut will cause the fuse nut to shatter! This will put your installation on hold. It is recommended that a separate means of disconnecting the positive battery cable be included in systems that use fuses.

UL listed DC rated circuit breakers are available from OutBack Power Systems with amperages of 100, 175 and 250 amps DC. All of the OutBack DC breakers come with threaded studs out the back for connection to ring type terminal lugs. **ALWAYS INSTALL BREAKERS OR FUSES WITHIN THE POSITIVE BATTERY CABLE.**

OutBack also offers stud mounted fuses (SMF) for non-NEC code installations in 100, 175, and 250 amp sizes. These are the same fuses included with the Mobile FX.

The minimum recommended cable size varies with the DC voltage. VFX2812, VFX2812M, FX2012T, FX2012MT, VFX3524 and VFX3524M installations must use 4/0 AWG (120mm<sup>2</sup>) cable minimum. VFX3648, FX2524T, FX2524MT, and FX3048T installations can use 2/0 AWG (70mm<sup>2</sup>) cable as long as the distances are short (less than 10 feet / 3 meters per cable). If longer distances are required, increase the cable size to the next size as a minimum. Keep the cables together as much as possible for their entire length. Tying or taping the cables together is also advisable.

## EQUIPMENT GROUND TERMINALS

A set-screw type box lug is provided near the DC terminals to allow the connection of an equipment grounding conductor for the metal chassis of the inverter. It is located behind the battery negative terminal on the top of the inverter casting. A green ground symbol marks the location. When mounting an FX to a PS2MP or PS4MP, a star washer located under one of the four screws that connect the FXs chassis to the mounting plate provides grounding of the FX to the mounting plate. Connection to the ground terminal is not required if the star washer is used to connect the FX to the mounting plate and the mounting plate is grounded.

## BATTERY TERMINAL COVERS

The battery terminal covers simply snap on. They are a little brittle, so use some care. Use a flat bladed screw driver blade in the slots provided on the sides of the cover to pry the cap off. If the installation is exposed, DC conduit may be required. Connection of 2-inch conduit is possible when the DCA option is added to the FX. **Always install the Battery Terminal Covers**, even in systems that have an DCC or a Turbo included.



### **ACA (AC CONDUIT ADAPTER)**

This plastic box slips into grooves on the AC end of the FX. This adapter extends the AC wiring compartment to match the PS4AC or PS2AC. It also provides more room for wiring than is available when using the supplied AC conduit plate.

There is a 2-inch TSC cut-out on the plastic box to allow it to be used with the PS4AC or PS2AC disconnect enclosure or 2-inch conduit.

The ACA may also be used for mounting two breakers OBDC breakers (rated for AC) and/or an AC outlet through the knockouts provided.



### **DCA (DC CONDUIT ADAPTER)**

The DCA allows the connection of 2-inch TSC conduit to the FX. It fits on the opposite end of the FX from the AC wiring compartment. The location of the 2-inch conduit opening matches the 2-inch knockouts provided in the PS4DC or PS2DC enclosure.

When installing an FX with a PS4DC or PS2DC disconnect enclosure, both the DCA and DCC (or Turbo) are required.



### **DCC (DC COMPARTMENT COVER)**

The DCC covers the DC terminal area and allows a space which can be used to mount other components such as a DC current shunt. The DCC can be used with or without the DCA.

When installing an FX with a PS4DC or PS2DC disconnect enclosure, both the DCA and DCC (or Turbo) are required.

The DCC is provided with all VFX inverter/chargers.



## TURBO KIT INFORMATION

The Turbo Kit is an addition that is either included or can be added to any sealed FX. Typically, the Turbo Kit adds 300-500 watts of power to a sealed FX. This extra power is included in the model number for sealed FXs that come with Turbos. If the sealed FX did not come with a Turbo and one is added, then the FX will be able to produce the extra 300-500 watts of power in addition to the power that the model number indicates. **Do not use the Turbo with a vented VFX! It will actually reduce the output power of the VFX!**

The Turbo is highly recommended in hot climates or for installations that can use a few hundred watts of extra power. In hot climates or when the FX is the primary charging device, the chances of the FX overheating are heightened. When the FX gets to its temperature limits, it will back off the charging process to avoid overheating (and a shutdown of the FX). The Turbo Kit solves this problem by directing air over the casting and its fins, thus causing better convection cooling of the FX.

The signal powering the Turbo Kit fan comes from the auxiliary output of the FX. The default setting of the auxiliary output is set to "CoolFan" which starts the Turbo Kit automatically when the FX starts heating up.

The instructions for adding a Turbo Kit are included with the Turbo Kit or the FX. If you are also automatically starting a generator using the auxiliary output, you can program the auxiliary output to "GenAlert" or use the Advanced Generator Start (AGS) system and parallel the generator start wires with the Turbo Kit wires. When the generator is running the Turbo Kit is also running. This solution works because the FX gets hottest when it is charging. If the paralleling of the generator and the Turbo Kit doesn't work properly, adding a 470 uF (micro Farad) electrolytic capacitor (found at your local electronics shop) across the auxiliary output will solve this problem.



# HUB COMMUNICATION MANAGER

The HUB communication manager allows the MATE to control and monitor a maximum of ten OutBack products. Currently the HUB comes in two types. The HUB-4 can connect up to four Outback products (FX's and/or MX-60's). The HUB-10 (shown below) can connect up to ten Outback products (FX's and/or MX-60's). The FX's can be operated in a stacked or independent configuration. If the FX's are to be stacked, the HUB must be part of the system. In a stacked configuration, the Master FX must be plugged into port #1 of the HUB. The Slave inverters must use the following ports (example: for 8 inverters and 2 MX-60's, the Master must be plugged into Port 1, and the seven Slaves must be plugged into Ports 2-8. The MX-60's can use Ports 9&10). Future OutBack products will also be compatible with the HUB. When using the HUB, the MATE must be plugged into the 1st MATE port of the HUB.

The HUB manages both the inter-FX communications and the MATE-FX communication.

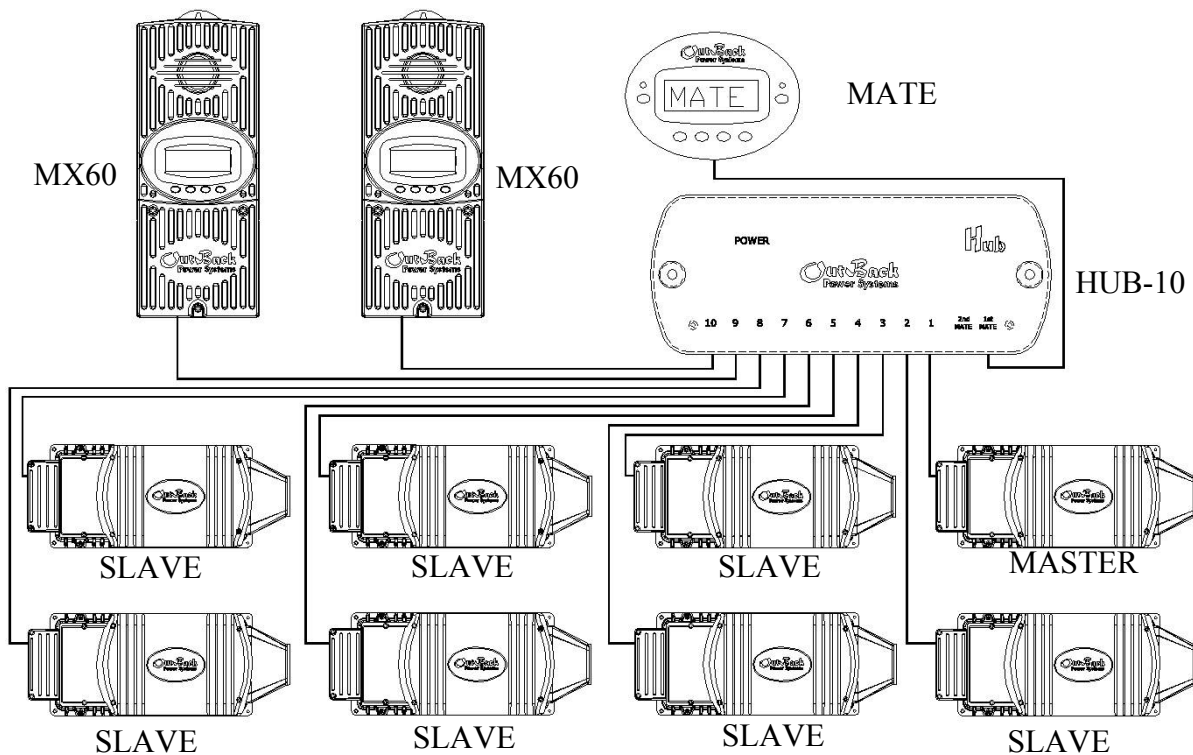
When a HUB is used in conjunction with the RTS, the RTS (Remote Temperature Sensor) must be plugged into the Master FX which must be plugged into port 1 of the HUB. If this is the case, only one RTS is required for all devices plugged into the HUB.

When two or more FX's are stacked in a series or parallel configuration, the system automatically turns off any excess slave FX's to save power and maximize conversion efficiency. This power save system is fully automatic and works with or without the MATE connected to the system. Some programming is required when more than two FXs are stacked together. See the STACKING INFORMATION section of this manual for more information.

Currently on 3-phase systems there is a limit of one FX per phase (totaling three FX's). To convert the HUB into 3-phase mode, you must move the jumper on the HUB to the "3-PH" position. See the HUB instruction manual for details.

One MATE system controller and display can be connected to the HUB. Although there are two Mate ports on the HUB, only the 1st Mate port is currently operational. The MATE can be located up to 1000 feet (305 meters) from the HUB / system location. Cabling from the HUB to the MATE is completed using standard CAT-5 type ethernet cable with RJ45 modular 8 conductor jacks. This wiring is considered to be low voltage / limited energy circuitry. Refer to the MATE manual for more information on the MATE.

All cabling from the FX and MX60 communication ports to the HUB is made with CAT-5 type ethernet cabling. The maximum distance from the HUB-4 to the FX or MX-60 should be less than 10 feet. OutBack includes two 3-foot (1 meter) and two 6-foot (2 meter) long CAT-5 cables standard with the HUB-4. OutBack includes two 3-foot (1 meter) long and four 6-foot (2 meter) long CAT-5 cables standard with the HUB-10. Check with your OutBack dealer for additional cables.



A total of up to ten OutBack products plus one MATE displays can be used with a HUB-10 (shown above).

The HUB-4 will only accept four OutBack products plus one MATE.

**NOTE:** There is a limit of ten FX's when operated as a stacked system.

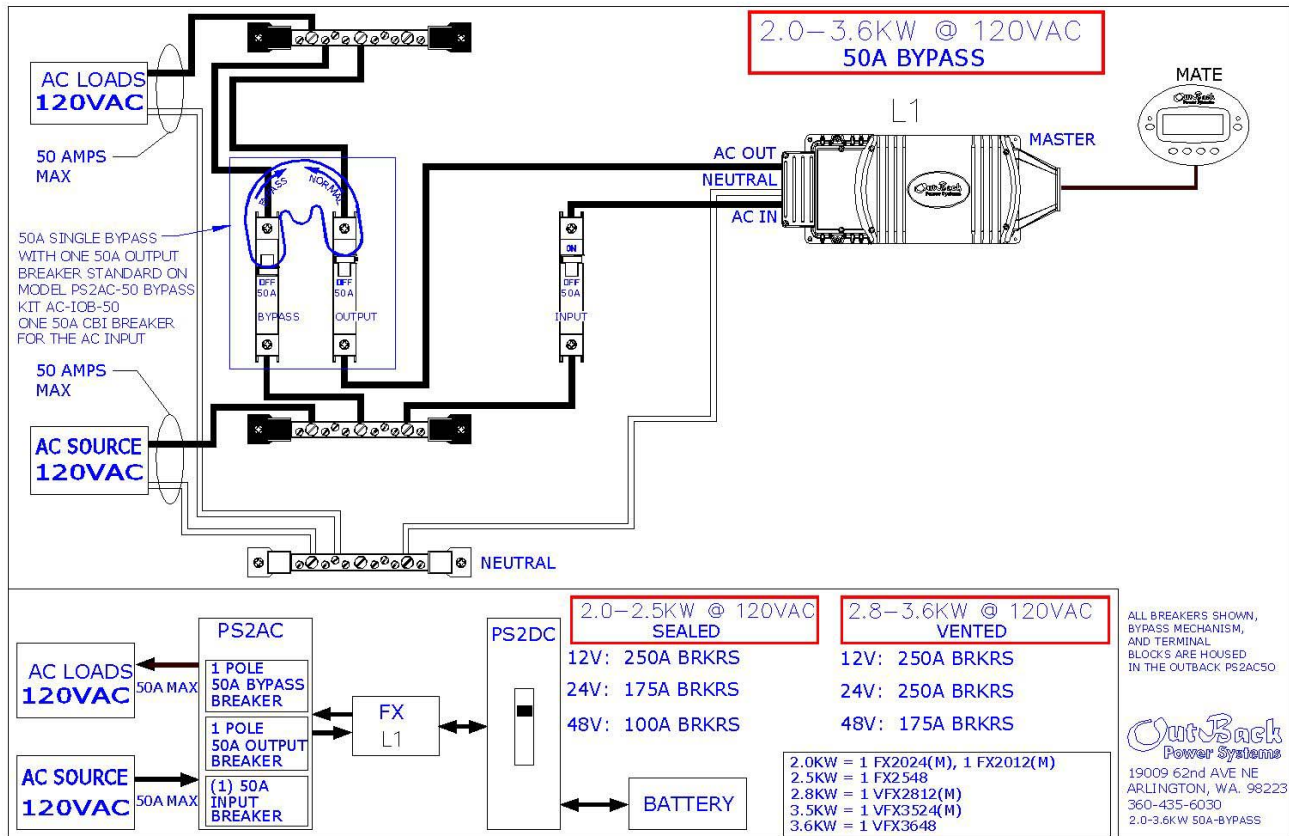


The FX System Configuration section shows diagrams of some typical system configurations using the FX. **These diagrams are for non-Mobile FX installations only.** Below these diagrams are notes for how to change each diagram to accommodate a Mobile installation. There are diagrams for a single FX, two FX's in series or series/parallel (see NOTE below), two FX's in parallel, four FX's in series/parallel (see NOTE below), four FX's in parallel, and a 3-phase system. The diagrams show the proper breakers and wiring for the AC side of the installations as well as connections to the HUB, MATE and X-240 (if applicable). Also included is information on the maximum continuous power of the systems and proper DC breaker sizes. This information is dependent on whether the FX's are sealed or vented and on the system's battery voltage.

**NOTE:** Stacking FX's in series/parallel means that there are FX's directly connected to two separate 120VAC output legs. These two 120VAC output legs produce 240VAC between them (the *series* portion). By connecting the X-240 autotransformer between the two 120VAC output legs, these legs are magnetically coupled (indirectly connected). This allows all of the FX's to power either of the 120VAC output legs (the *parallel* portion). Series/parallel stacking requires the use of the X-240 autotransformer and must use "OutBack" stacking programming.

## Single FX System

The following diagram illustrates a typical single FX installation. **This diagram is for a non-Mobile FX installation only.** Below this diagram are notes for how to change this diagram to accommodate a Mobile installation. All AC wiring must handle a capacity of 50 amps AC or more. For 'Mobile' FX's, a 30A input breaker should be used due to the maximum AC input pass-through rating of the Mobile FX's. A single FX system can continuously power 2-3.6KW of loads depending on which model is used. Connecting more power than the continuous rating of the FX may cause breakers to trip or the FX to shut off its AC output. A MATE must be connected to adjust any parameters or to display any meters. Once the FX has been programmed using the MATE, the MATE can be disconnected. The programming will be saved within the FX's non-volatile memory even if the FX is completely shut down.

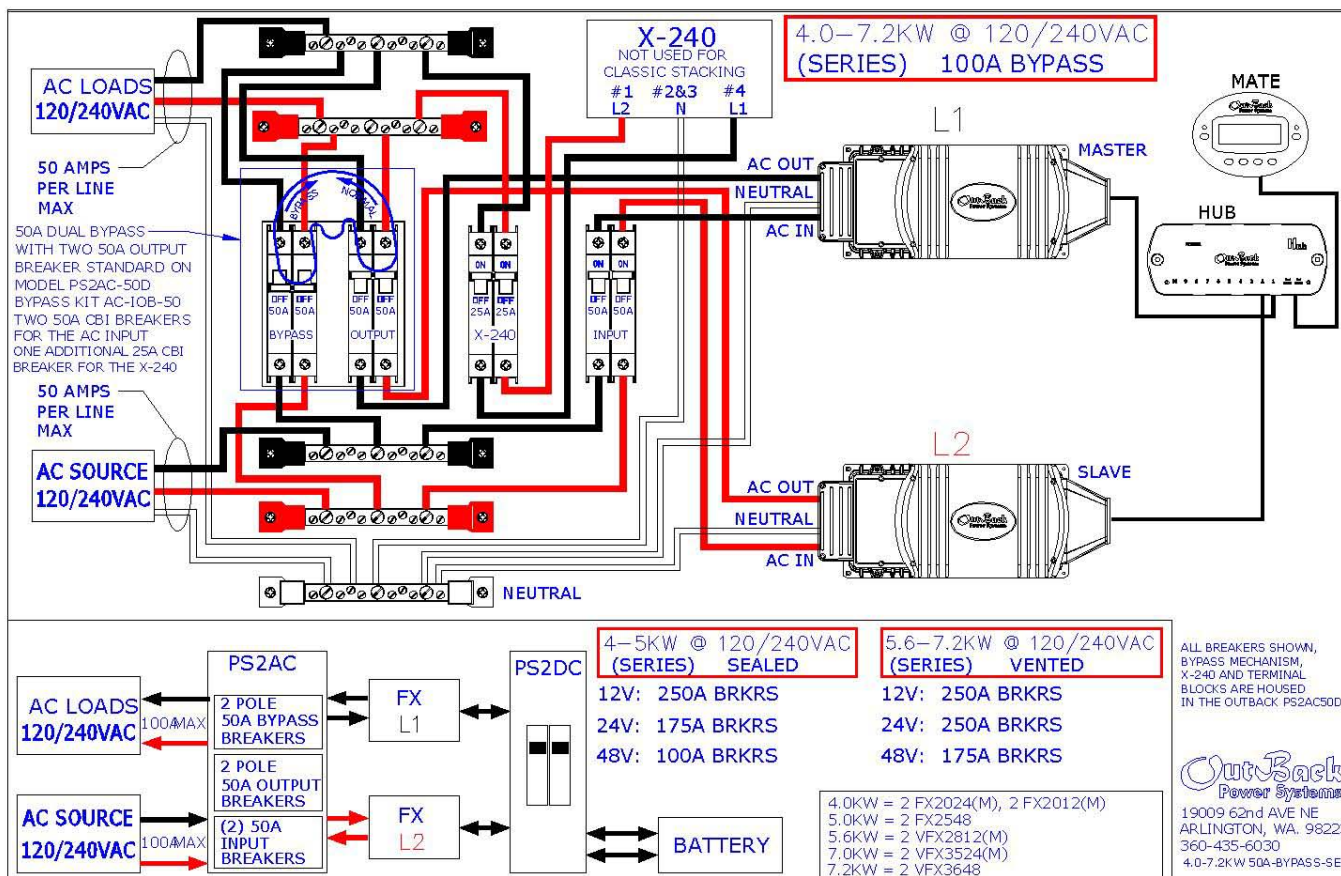


**NON-MOBILE FX NOTES:** The AC OUTPUT NEUTRAL IS NOT BONDED TO THE CHASSIS OR THE GROUND TERMINAL of the FX system. This connection is to be made by the installer either in the AC service entrance or within the AC load distribution panel of the electrical system. The AC input, AC output and DC terminals are isolated from the metal chassis of the FX. Proper grounding of these circuits and the chassis of the FX is the responsibility of the installer.

**MOBILE FX NOTES:** The AC input source to the FX (grid and/or generator) must have an internal neutral-ground connection. On the above diagram the AC source's neutral conductor must go directly to the FX's AC NEUTRAL IN terminal or to a separate neutral busbar that is isolated from the FX's AC output neutral. The AC output of the FX must go to a separate AC output busbar that is isolated from the AC input neutral. A bypass mechanism must bypass the AC source's hot and neutral wires. Proper grounding of the DC circuit and the chassis of the FX is the responsibility of the installer.

## Series or Series/Parallel Dual FX System

The following diagram illustrates a typical series FX installation using two FX's. **This diagram is for a non-Mobile FX installation only. Below this diagram are notes for how to change this diagram to accommodate a Mobile installation.** The AC wiring from the AC source and to the AC loads must handle 50 amps AC or more. All other AC wiring must handle a capacity of 50 amps AC or more. For a 'Mobile' FX system, 30A input breakers should be used due to the maximum AC input pass-through rating of the Mobile FX's. This type of FX system can continuously power 4-7.2KW of loads depending on which model is used. Connecting more power than the continuous rating of the FX may cause breakers to trip or the FX to shut off its AC output. A HUB and a MATE must be connected to stack these FX's in series. The MATE must be connected to adjust any parameters or to display any meters. The slave FX must be programmed through the MATE as a 'Classic Slave' (series stacking, no X-240) or as 'OB Slave L2' (series/parallel stacking, X-240 included). Once the FX has been programmed using the MATE, the MATE can be disconnected. The programming will be saved within the FX's non-volatile memory even if the FX is completely shut down.



**NOTES:** The X-240 autotransformer (located at the top-middle of the diagram) should never be used in a system that is programmed for "Classic" stacking. If an X-240 is connected between two 120 VAC output legs, program the top FX as Master (1-2PH MASTER) and the lower FX as an OutBack L2 slave (OB SLAVE L2). If the X-240 is not included in the system program the top FX as Master (1-2PH MASTER) and the lower FX as an OutBack L2 slave (OB SLAVE L2). See the STACKING INFORMATION section of the manual for more info.

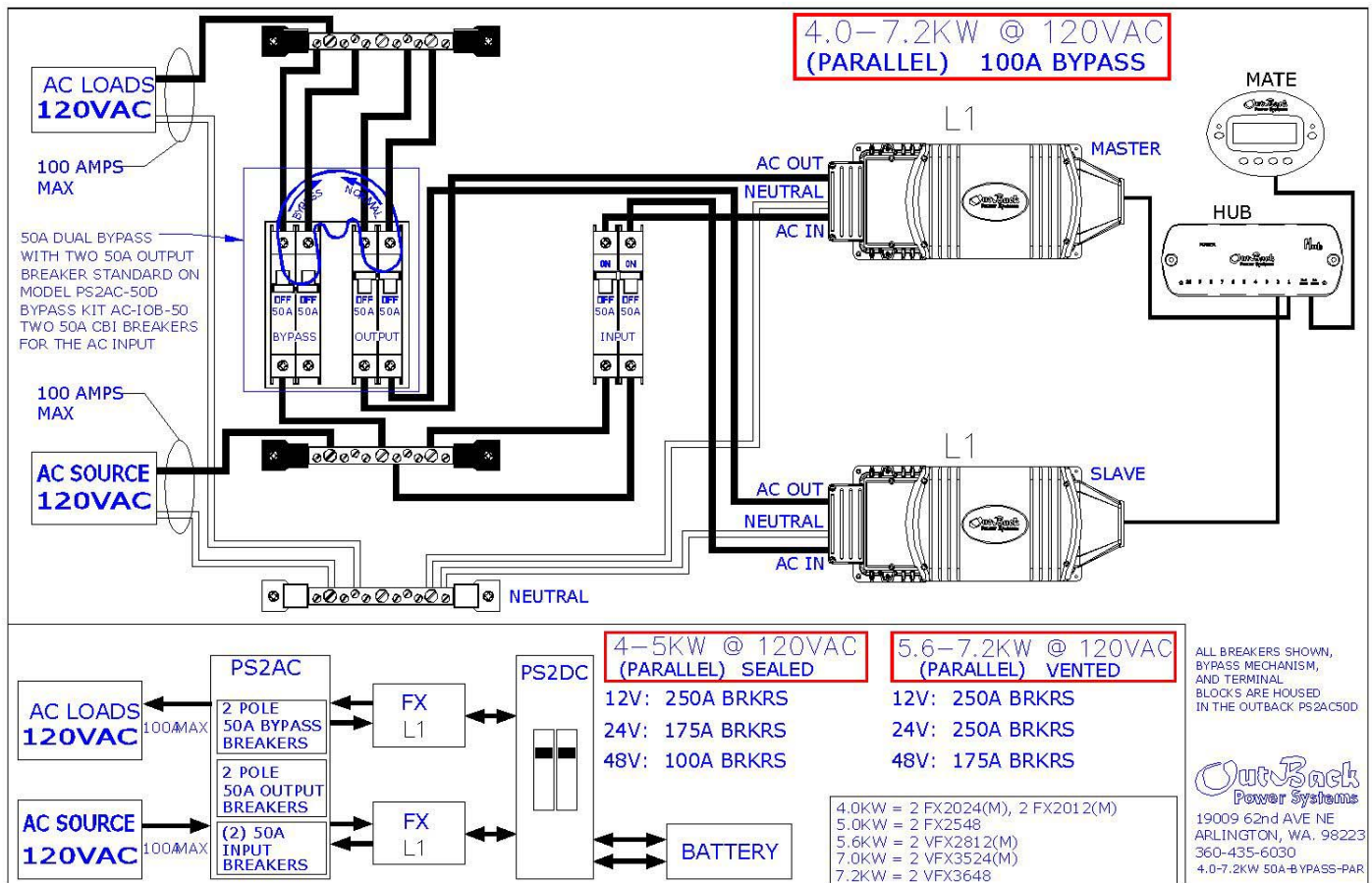
When the FX's are connected in series for 120/240 VAC, the X-240 autotransformer can be connected to the AC output to allow both of the FX's capacity to be available on either of the 120 VAC output circuits. This allows higher efficiency and better performance as heavy 120 VAC loads are powered by both of the FX's. The X-240 autotransformer also allows the master to power loads on either of the 120 VAC output circuits with the slave off. This reduces the idle power consumption and improves the system efficiency.

**NON-MOBILE FX NOTES:** The AC OUTPUT NEUTRAL IS NOT BONDED TO THE CHASSIS OR THE GROUND TERMINAL of the FX system. This connection is to be made by the installer either in the AC service entrance or within the AC load distribution panel of the electrical system. The AC input, AC output and DC terminals are isolated from the metal chassis of the FX. Proper grounding of these circuits and the chassis of the FX is the responsibility of the installer.

**MOBILE FX NOTES:** The AC input source to the FX (grid and/or generator) must have an internal neutral-ground connection. On the above diagram the AC source's neutral conductor must go directly to the FXs AC NEUTRAL IN terminal or to a separate neutral busbar that is isolated from the FX's AC output neutral. The AC output of the FX must go to a separate AC output busbar that is isolated from the AC input neutral. A bypass mechanism must bypass the AC source's hot and neutral wires. Proper grounding of the DC circuit and the chassis of the FX is the responsibility of the installer.

## Paralleled Dual FX System

The following diagram illustrates a typical paralleled FX installation using two FX's. **This diagram is for a non-Mobile FX installation only. Below this diagram are notes for how to change this diagram to accommodate a Mobile installation.** The AC wiring from the AC source and to the AC loads must handle 100 amps AC or more. All other AC wiring must handle a capacity of 50 amps AC or more. For a 'Mobile' FX system, 30A input breakers should be used due to the maximum AC input pass-through rating of the Mobile FX's. This type of FX system can continuously power 4-7.2KW of loads depending on which model is used. Connecting more power than the continuous rating of the FX may cause breakers to trip or the FX to shut off its AC output. A HUB and a MATE must be connected to stack these FX's in parallel. The MATE must be connected to adjust any parameters or to display any meters. Once the FX has been programmed using the MATE, the MATE can be disconnected. The programming will be saved within the FX's non-volatile memory even if the FX is completely shut down.



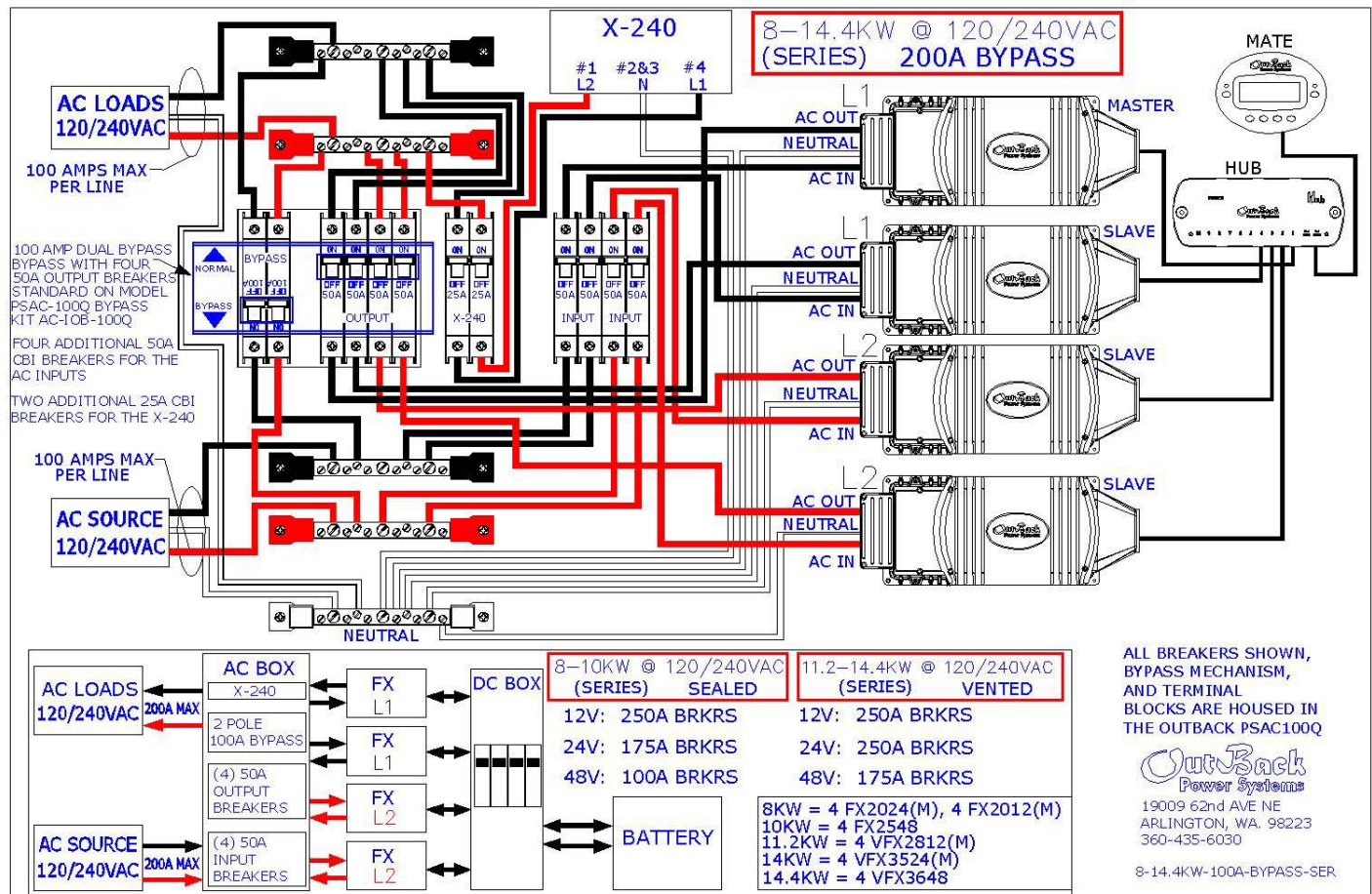
**NOTES:** Program the top FX as Master (1-2PH MASTER) and the lower FX as an OutBack L1 Slave (OB SLAVE L1). See the STACKING INFORMATION section of the manual for more info.

**NON-MOBILE FX NOTES:** The AC OUTPUT NEUTRAL IS NOT BONDED TO THE CHASSIS OR THE GROUND TERMINAL of the FX system. This connection is to be made by the installer either in the AC service entrance or within the AC load distribution panel of the electrical system. The AC input, AC output and DC terminals are isolated from the metal chassis of the FX. Proper grounding of these circuits and the chassis of the FX is the responsibility of the installer.

**MOBILE FX NOTES:** The AC input source to the FX (grid and/or generator) must have an internal neutral-ground connection. On the above diagram the AC source's neutral conductor must go directly to the FXs AC NEUTRAL IN terminal or to a separate neutral busbar that is isolated from the FX's AC output neutral. The AC output of the FX must go to a separate AC output busbar that is isolated from the AC input neutral. A bypass mechanism must bypass the AC source's hot and neutral wires. Proper grounding of the DC circuit and the chassis of the FX is the responsibility of the installer.

## Series/Parallel Quad FX System

The following diagram illustrates a typical series/parallel FX installation using four FX's. **This diagram is for a non-Mobile FX installation only. Below this diagram are notes for how to change this diagram to accommodate a Mobile installation.** The AC wiring from the AC source and to the AC loads must handle 120 amps AC or more. The AC wiring connected to the QUO 100A dual bypass breakers must handle 100 amps AC or more. All other AC wiring must handle a capacity of 50 amps AC or more. For a 'Mobile' FX system, 30A input breakers should be used due to the maximum AC input pass-through rating of the Mobile FX's. This type of FX system can continuously power 8-14.4KW of loads depending on which model is used. Connecting more power than the continuous rating of the FX may cause breakers to trip or the FX to shut off its AC output. A HUB, MATE and X-240 must be connected to successfully stack these FX's in series/parallel. The MATE must be connected to adjust any parameters or to display any meters. Once the FX's have been programmed using the MATE, the MATE can be disconnected. The programming will be saved within the FX's non-volatile memory even if the FX is completely shut down.



**NOTES:** Program the top FX as the Master (1-2PH MASTER), the first Slave as an Outback L1 slave (OB Slave L1), and the second and third Slaves as OutBack L2 slaves (OB SLAVE L2). See the STACKING INFORMATION section of the manual for more info.

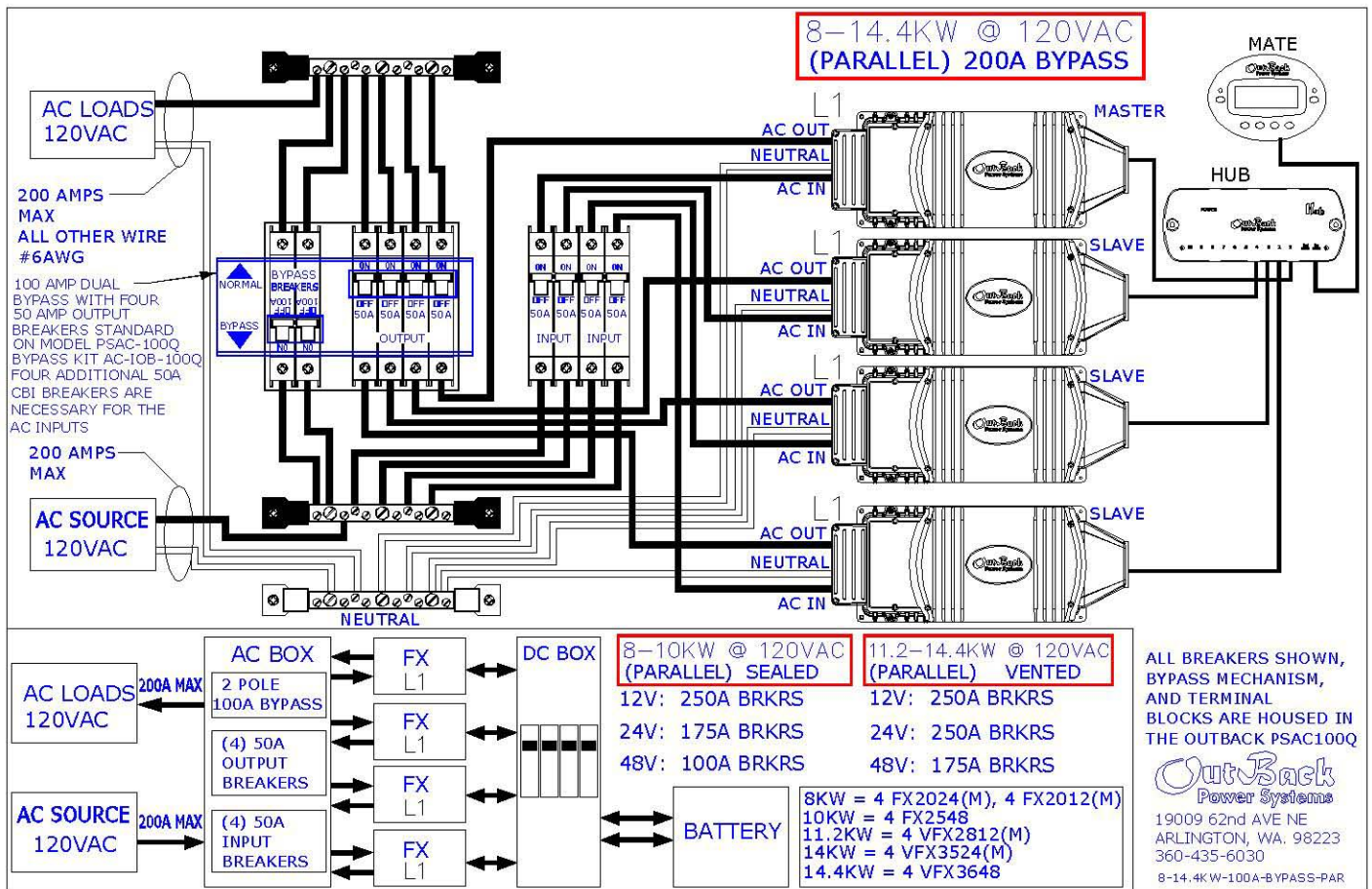
In systems that include three or more FX's and must be series stacked, an X-240 autotransformer **must** be used. When the FX's are connected in series for 120/240 VAC, the X-240 can be connected to the two AC output legs to allow all of the FX's capacity to be available on either of the 120 VAC output circuits. This allows higher efficiency and better performance as heavy 120 VAC loads are powered by more of the FX's. The X-240 also allows the master to power loads on either of the 120 VAC output circuits with the slave off. This reduces the idle power consumption and improves the system efficiency.

**NON-MOBILE FX NOTES:** The AC OUTPUT NEUTRAL IS NOT BONDED TO THE CHASSIS OR THE GROUND TERMINAL of the FX system. This connection is to be made by the installer either in the AC service entrance or within the AC load distribution panel of the electrical system. The AC input, AC output and DC terminals are isolated from the metal chassis of the FX. Proper grounding of these circuits and the chassis of the FX is the responsibility of the installer.

**MOBILE FX NOTES:** The AC input source to the FX (grid and/or generator) must have an internal neutral-ground connection. On the above diagram the AC source's neutral conductor must go directly to the FX's AC NEUTRAL IN terminal or to a separate neutral busbar that is isolated from the FX's AC output neutral. The AC output of the FX must go to a separate AC output busbar that is isolated from the AC input neutral. A bypass mechanism must bypass the AC source's hot and neutral wires. Proper grounding of the DC circuit and the chassis of the FX is the responsibility of the installer.

## Paralleled Quad FX System

The following diagram illustrates a typical paralleled FX installation using four FX's. **This diagram is for a non-Mobile FX installation only. Below this diagram are notes for how to change this diagram to accommodate a Mobile installation.** The AC wiring from the AC source and to the AC loads must handle 200 amps AC or more. The AC wiring connected to the QUO 100A dual bypass breakers must handle 100 amps AC or more. All other AC wiring must handle a capacity of 50 amps AC or more. For a 'Mobile' FX system, 30A input breakers should be used due to the maximum AC input pass-through rating of the Mobile FX's. This type of FX system can continuously power 8-14.4KW of loads depending on which model is used. Connecting more power than the continuous rating of the FX may cause breakers to trip or the FX to shut off its AC output. A HUB and a MATE must be connected to stack these FX's in parallel. The MATE must be connected to adjust any parameters or to display any meters. Once the FX has been programmed using the MATE, the MATE can be disconnected. The programming will be saved within the FX's non-volatile memory even if the FX is completely shut down.



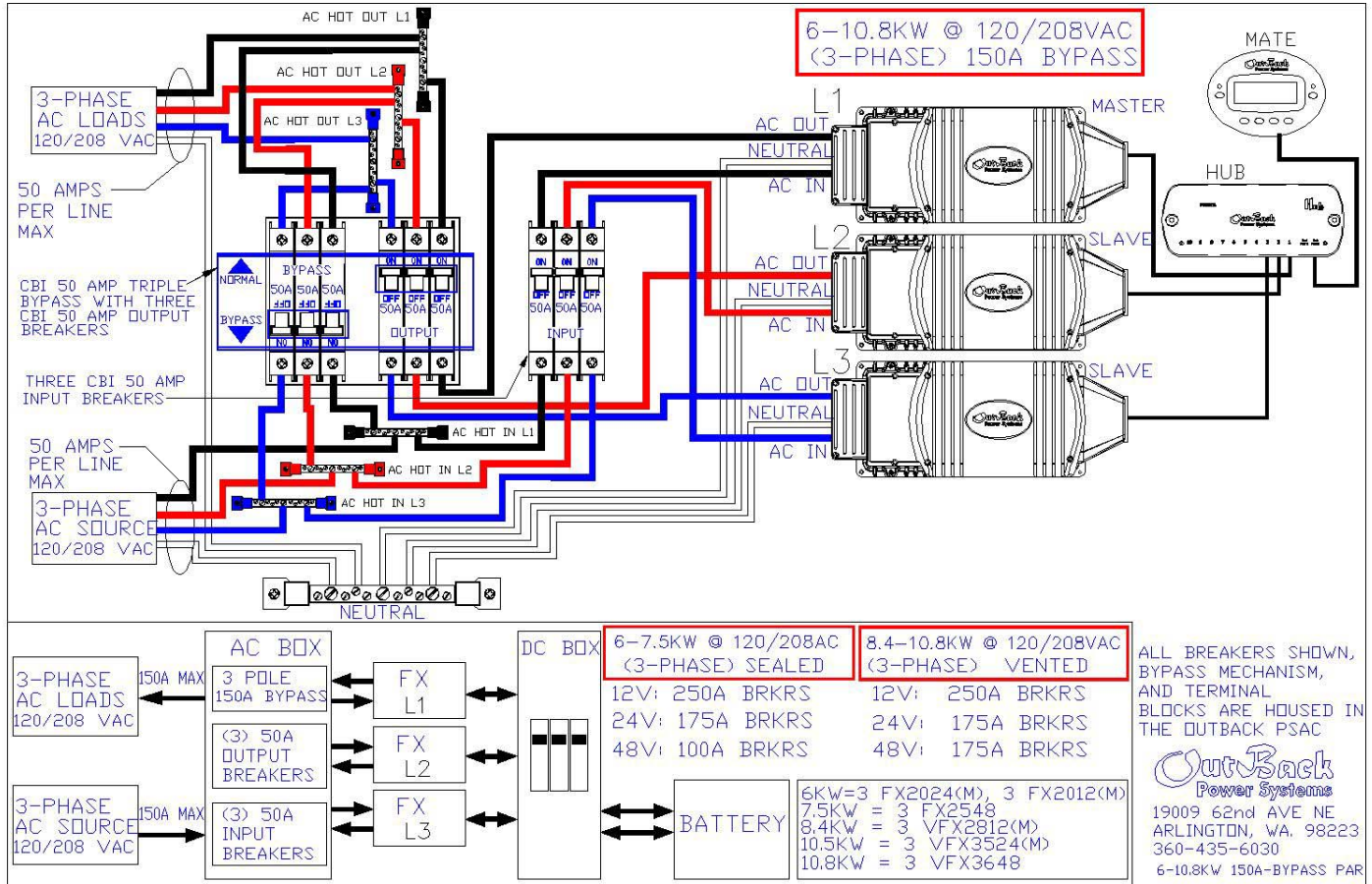
**NOTES:** Program the top FX as Master (1-2PH MASTER) and the three lower FX's as OutBack L1 Slaves (OB SLAVE L1). See the STACKING INFORMATION section of the manual for more info.

**NON-MOBILE FX NOTES:** The AC OUTPUT NEUTRAL IS NOT BONDED TO THE CHASSIS OR THE GROUND TERMINAL of the FX system. This connection is to be made by the installer either in the AC service entrance or within the AC load distribution panel of the electrical system. The AC input, AC output and DC terminals are isolated from the metal chassis of the FX. Proper grounding of these circuits and the chassis of the FX is the responsibility of the installer.

**MOBILE FX NOTES:** The AC input source to the FX (grid and/or generator) must have an internal neutral-ground connection. On the above diagram the AC source's neutral conductor must go directly to the FXs AC NEUTRAL IN terminal or to a separate neutral busbar that is isolated from the FX's AC output neutral. The AC output of the FX must go to a separate AC output busbar that is isolated from the AC input neutral. A bypass mechanism must bypass the AC source's hot and neutral wires. Proper grounding of the DC circuit and the chassis of the FX is the responsibility of the installer.

### 3-Phase FX System

The following diagram illustrates a typical 3-phase FX installation using three FX's. **This diagram is for a non-Mobile FX installation only. Below this diagram are notes for how to change this diagram to accommodate a Mobile installation.** This system will produce 120VAC per phase and 208VAC from phase to phase. At this time there can only be one FX per phase on a 3-phase system. The AC wiring from the AC source and to the AC loads must handle 50 amps AC or more. All other AC wiring must handle a capacity of 50 amps AC or more. For a 'Mobile' FX system, 30A input breakers should be used due to the maximum AC input pass-through rating of the Mobile FX's. This type of FX system can continuously power 6-10.8KW of loads depending on which model is used. Connecting more power than the continuous rating of the FX may cause breakers to trip or the FX to shut off its AC output. A HUB and a MATE must be connected to stack these FX's in 3-phase. The MATE must be connected to adjust any parameters or to display any meters. A jumper in the HUB must be moved to let the system operate in 3-phase. Check the HUB manual for instructions. Once the FX has been programmed using the MATE, the MATE can be disconnected. The programming will be saved within the FX's non-volatile memory even if the FX is completely shut down.



**NOTES:** Program the top FX as Master (3PH MASTER) and the two lower FX's as 3-phase Slaves (3PH SLAVE). See the STACKING INFORMATION section of the manual for more info. The 3-phase system is a 120/208 VAC Y-connected power system. The AC source must also be a 120/208 VAC Y-connected 3-phase source.

**NON-MOBILE FX NOTES:** The AC OUTPUT NEUTRAL IS NOT BONDED TO THE CHASSIS OR THE GROUND TERMINAL of the FX system. This connection is to be made by the installer either in the AC service entrance or within the AC load distribution panel of the electrical system. The AC input, AC output and DC terminals are isolated from the metal chassis of the FX. Proper grounding of these circuits and the chassis of the FX is the responsibility of the installer.

**MOBILE FX NOTES:** The AC input source to the FX (grid and/or generator) must have an internal neutral-ground connection. On the above diagram the AC source's neutral conductor must go directly to the FXs AC NEUTRAL IN terminal or to a separate neutral busbar that is isolated from the FX's AC output neutral. The AC output of the FX must go to a separate AC output busbar that is isolated from the AC input neutral. A bypass mechanism must bypass the AC source's hot and neutral wires. Proper grounding of the DC circuit and the chassis of the FX is the responsibility of the installer.

Once the FX system installation is completed, it is time to power the system. Leave the breakers on the AC side in the OFF position until the FX's are powered and programmed. Power the FX's (and any MX-60 charge controllers) by switching the DC disconnect breakers to the ON position. The LED's (Light Emitting Diodes) in the AC compartment of each FX will begin to light. For each FX, one "BATTERY" LED will be lit. This "BATTERY" LED should be either the green "FULL" LED or yellow "OK" LED. If the red "LOW" LED is lit, check the battery voltage and the battery-to-FX cabling for reasons why the FX thinks the batteries are low. The other set of "STATUS" LED's will begin to light. The red "ERROR" LED may blink a few times, but this is just a symptom of powering the FX. About 5 seconds to 10 seconds after power is applied, the green "INVERTER" LED should be lit and the "AC IN" and "ERROR" LED's should not be lit.

At this point, the FX is producing an AC output voltage, or inverting, hence the reason the "Inverter" LED is lit. If the user were to connect AC loads to the FX, the FX would use battery power to produce AC power to power the loads. Before doing this, the programming of the FX should be performed using the MATE. If applicable, this programming should include the following:

- Choose the AC input type of grid or generator. Generator is the default. See the SETUP MENU page in the ADVANCED section for more info.
- Stacking of multiple FX's. See the STACKING INFORMATION and the STACKING INSTRUCTION sections for proper setup info. Also see the STACKING MENU in the ADVANCED section for programming info.
- Adjust the charging set points using the battery manufacturers specification. See the BATTERY CHARGING INFORMATION section to directions and familiarity of the FX's charging process. Also see the CHARGER MENU in the ADVANCED section for programming info.
- Set the time and the date on the MATE (see MATE manual).
- Program the Auxiliary output for the function you wish it to perform. If you wish to automatically start a generator, see the AUTOMATIC GENERATOR START section of this manual (you may also need the MATE manual). In any case, also see the AUXILIARY MENU in the ADVANCED section of this manual for programming info.
- Perform any other programming that you wish in the ADVANCED section of this manual.

The FX system is now ready to perform per your specification. Switch the AC output breakers on with the bypass mechanism switched to "Normal". If there are X-240 breakers switch them on at this time. Next, switch on the AC input breakers. Provided that the AC source to the FX's is available, the yellow "AC IN" LED in the AC compartment will begin to blink. If the voltage of the utility grid or generator is within 108 vac to 140 vac and the frequency is within 54 Hz to 66 Hz, the FX will connect to the utility grid or generator. This process takes about 30 seconds and the "AC IN" LED will stop blinking and stay lit when connection occurs.

When the "AC IN" LED is lit, the AC transfer switch within the FX is activated and the utility grid or generator power is applied to the loads. At this time the FX will perform a charge on the batteries. The charging process is different depending on whether the generator has been started automatically or manually. The start of either charging process will "Bulk" (raise) the battery voltage until they reach the "Absorb" voltage. The FX will maintain this "Absorb" voltage for the "Absorb Time Limit" (default of 1 hour). If the generator had been automatically started, the generator will now be shut off. However, if the generator had been manually started the charging process continues. After the "Absorb" stage, the FX goes into "Silent" mode, letting the battery voltage drop until it levels out. If the battery voltage drops to the "Re-Float" voltage the FX will perform a "Float" charge. It raises the battery voltage to the "Float" voltage and it then sustains this voltage for the "Float Time Period" (default of 1 hour). Once this hour is up, the FX will go back into "Silent" mode, and again wait for the battery voltage to drop to "Re-Float". This process of "Silent", "Re-Float", "Float", "Silent", "Re-Float", etc. will continue until the generator is manually shut off.

# BATTERY CHARGING INFORMATION

A battery bank may last for over 10 years if properly cared for, but it can also be ruined in less than a month if not properly charged. Batteries represent a large percentage of the cost of a system. Keeping your battery bank healthy is very important.

## BATTERY CHARGING SETPOINTS

It is necessary for the system operator to gather the following information from the battery manufacturer:

- The 'Absorb' Voltage
- The 'Float' Voltage
- The 'Equalize' Voltage

If you don't obtain and enter this information into the MATE, you could be overcharging or undercharging the batteries. The FX's default charging settings are set to low values to protect from overcharging of the batteries so, to be safe, make the call. These 'Absorb', 'Float', and 'Equalize' voltage set points as well as the 'Absorb Time Period' should be programmed into the FX through the MATE in the ADV/FX/CHARGER menu section. To access this section, refer to the "Menu Map" and "Charger Menu" located in the "MATE SCREENS" section of this manual.

### A Note on the Absorb Setting:

Some battery manufacturers recommend a low 'Absorb' voltage and a long 'Absorb Time Period', claiming that this will extend the life of the batteries. This may be true, but remember that the longer the 'Absorb Time Period' the longer your generator will run. The cost for gas and the wear on the generator may outweigh the projected loss of life on your batteries. Since most of the charge gets put back into the batteries before they reach the 'Absorb' voltage, a higher 'Absorb' voltage may be better. This means more battery maintenance (watering) and more gassing (always vent the batteries out of the building) but will save you money on gas and generator repairs. Please ask the battery manufacturer for the maximum 'Absorb' voltage of the batteries.

## BATTERY EQUALIZATION

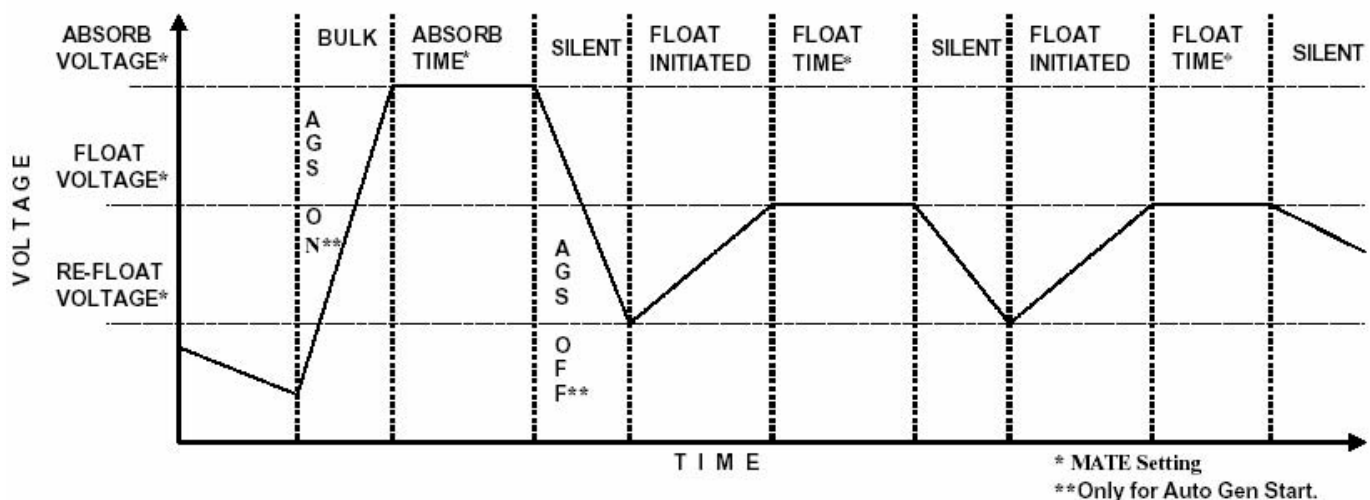
In order to make sure the batteries stay healthy, they should not be discharged over 50% and should be regularly charged back to near-full capacity. For flooded lead-acid batteries, full capacity is only achieved by equalizing the batteries. Sealed batteries should never be equalized unless specifically recommended by the battery manufacturer. An 'Equalize' charge should be performed every one to six months depending on how deep and how often your batteries get discharged. The FX will not automatically perform an 'Equalize' charge. The user must use the MATE to manually start an Equalize charge. **Check with the battery manufacturer for proper equalizing instructions.**

## RTS – THE REMOTE TEMPERATURE SENSOR

The "Temperature Compensated Battery Voltage" is on the MATE screen – Main / Status / FX / Batt / Down. When an RTS is plugged into the system, the 'Absorb', 'Float' and 'Equalize' voltage set points are temperature compensated. The 'Refloat' voltage, generator-start set points and all low-battery voltage initializations are not temperature compensated.

## BATTERY CHARGING SEQUENCE

The following diagram shows the algorithm that the FX uses to charge the batteries. When an AC voltage source is connected to the FX's AC input terminals, the FX will connect in about 30 seconds (default setting) and pass the AC voltage from the AC source through the FX's AC transfer switch to the loads connected to the FX's AC output terminals. When an AC voltage source connects to the FX, a battery charging sequence begins.





The following bullets describe the steps in the battery charging sequence.

- The first stage of the charging sequence is the “Bulk” stage. The FX uses as much AC current as possible from the AC input source to raise the battery voltage to the “Absorb” voltage setting. See the “Maximum Current for Battery Charging” heading in the RATINGS section for the FX’s default and maximum values of the AC current used for charging. The time period of the “Bulk” stage will vary with the battery bank’s age, capacity, voltage and AC source.
- Once the “Absorb” voltage has been reached, the FX will use the necessary AC current to sustain this voltage for the “Absorb Time” (default of 1 hour). The AC current will decrease as the “Absorb” charge continues.
- After the “Absorb Time Period”, the FX goes into “Silent” mode. The charger is turned off and the FX continues to monitor the battery voltage. If a generator has been automatically started on a low voltage condition using AGS (see MATE manual), the FX will automatically turn off the generator after the “Absorb Time Period”.
- If a generator has been manually started or the utility grid is connected, the FX will let the battery voltage drop to the “Refloat” voltage and then it will start a ‘Float’ charge.
- The ‘Float’ stage will raise the battery voltage to the “Float Setpoint” for the “Float Time Limit”. The ‘Float’ stage is meant for maintaining batteries that have DC loads connected to them. If there aren’t any DC loads on the batteries, the battery voltage will usually remain above the “Refloat” voltage set point.
- After the “Float Time Limit” (default of 1 hour), the FX goes back into ‘Silent’ mode and waits until the battery voltage drops to the ‘Refloat’ voltage again. It then repeats the ‘Float’ charge for the “Float Time Period”. The FX will continue this cycle of ‘Silent’, ‘Refloat’ and ‘Float’ until the AC source is disconnected.

### BATTERY CHARGING CONSTRAINTS

There are some settings and situations that affect the battery charging process. These settings and situations are described by the following bullets.

- **Rated Continuous Current of the AC Input Source:** This applies to generators only since the utility grid can produce power levels much higher. This setting is for the maximum AC generator current (at 120 VAC) that the FX will accept before it turns down its charger. This setting is called “AC/2 Gen Limit” and can be accessed through the MATE by following the path **Main / Setup / FX / Input / Down / Down**. The rated continuous AC current of the generator should be set in this screen. When the combined AC current used by the FX’s charger and the loads connected to the FX’s AC output exceed this “AC/2 Gen Limit” the FX will reduce the AC current used for the charger to ensure that the generator is not overloaded.
- **Low AC Input Voltage:** When the FX is connected to an AC input source, it passes through the AC input source’s voltage and current. The FX has minimum and maximum voltage settings for the AC input source to ensure that the AC input source does not damage downstream loads with low or high voltage. If the FX is charging and passing through power, the AC input source voltage can be dragged down to the FX’s low voltage limit. When this happens, the FX will back off the charger to sustain an acceptable voltage. If the FX goes below the low voltage limit, it will disconnect from the AC input source and cease charging. If you are experiencing low AC input voltage from a generator it is possible to adjust some generators to raise their voltage.
- **External “Dump Load” is Limiting Battery Voltage:** Many systems include sources of power that vary depending on the weather, such as wind turbines and micro-hydro systems. In high wind or water conditions, these power sources can produce voltages above what the battery bank should handle. These systems often use “Dump Loads” to get rid of this extra power at a particular battery “Dump” voltage. Sometimes the battery “Dump” voltage is below the FX’s “Target” voltage (“Target” voltage refers to a voltage set point that the FX is trying to reach; like “Absorb”, “Float” or “Equalize”). If the “Dump” voltage is below the “Target” voltage, the FX will never reach the “Target” because the “Dump Load” limits the battery voltage. The FX will continue to try to charge the batteries to the “Target” voltage while the “Dump Load” will continue to “Dump” the FX’s charging power. Since the FX wants to complete a charge, it will be stuck charging. This can cause a generator to run until it runs out of gas or, if connected to the utility grid, it can cause a lot of unnecessary power consumption (\$\$\$). To remedy this situation, reduce the FX’s “Target” voltage to a value slightly below the “Dump Load” voltage or raise the “Dump Load” voltage above the FX’s “Target” voltage (remember not to overcharge the batteries).
- **AC Input Voltage is Different on Different Legs:** In systems that have multiple AC input legs (120/240 VAC split phase or 120/208 VAC three phase) there are often slightly different voltages present on each leg. This is more likely with generators since their power is small compared to the utility grid. When the AC voltage on one leg is reduced to the FX’s AC input “Lower Limit”, the FX(s) connected to that particular leg will reduce their charging current so as not to disconnect from the AC input source. This is a similar situation as the “**Low AC Input Voltage**” bullet above but with multiple AC input legs. The other FXs on the other AC input legs will not reduce their charging rates unless they too have reached a “Lower Limit” voltage condition.
- **Temperature Limit is Reached:** Each FX has three temperature sensors that measure the temperature of the FX’s capacitors, FETs, and transformer. These temperature sensors will indicate when a temperature has been reached that will adversely affect the FX’s operation. At these temperatures, the FX will back off the charger to reduce the temperature to a sustainable level. If you notice that the FX is not charging as hard as you think it should and the FX is very hot to the touch (and it gets hot!) you can be assured that the FX is limiting the charge due to heat.
- **Battery Voltage “Target” is Reached:** In a system that has only one FX, that FX will back off the charger when it reaches a “Target” voltage (“Target” voltage is either “Absorb”, “Float” or “Equalize”). In a system with multiple FX’s, the “Slave” FX’s will back off before the “Master” FX, leaving the “Master” FX to finish the charge.

### Classic, OutBack, and 3-Phase Stacking Methods

OutBack Power Systems offers four different ways to stack multiple FX's (up to 10 for single or split phase systems, only 3 for three-phase systems). The first thing to consider is if you want all of the FX's in **parallel** (FX's on same AC Output Leg producing 120VAC only), in **series** (FX's divided between two AC Output Legs producing 120VAC on each Leg and 240VAC between the two Legs), or in **3-phase** (maximum of three FX's, one on each AC Output Leg, producing 120VAC on each Leg and 208VAC between each set of Legs). A HUB-4 or HUB-10 must be included to stack FX's.

If you choose to stack the FX's in **series**, the second thing to consider is how many FX's you will use. If you are series stacking three to ten FX's, you *must* use "OutBack" stacking and include an X-240 autotransformer. If you are series stacking only two FX's, you can choose between "Classic" stacking and "OutBack" stacking. Keep in mind that if you choose to series stack FX's using "OutBack" stacking, you must include an X-240 autotransformer in the system. Below is an explanation of each type of system.

**The next four pages explain the Stacking menu and how to program the various types of stacked systems.**

**PARALLEL (OUTBACK):** This stacking method pertains to a system that has two to ten FX's all connected to the same 120VAC Output Leg. The system can be programmed such that only one FX (the Master) stays "On" and the rest of the FX's (the Slaves) are asleep. The Slaves come on only when the power requirement is high enough that the Master FX calls on the Slave FX's to help with the load. It is also possible to program the system to keep any number of FX's "On" while the remaining FX's are asleep. The AC Input source (usually a generator or utility grid) must be 120VAC or stepped-down to 120VAC from a 240VAC source using the X-240 autotransformer.

**SERIES (CLASSIC):** This stacking method pertains to a system that has only two FX's and two 120VAC Output Legs that will produce 240VAC between them. In this system the Master FX and the Slave FX operate independently from each other. In other words, each FX will power its own 120VAC Output Leg but if any 240VAC loads need to be powered both FX's will be used. The AC Input source (generator or grid) must be 240VAC for both Legs to be powered.

**SERIES (OUTBACK):** This stacking method pertains to a system that has two to ten FX's connected to two 120VAC Output Legs that will produce 240VAC between them. In this stacking method the FX's will be connected to either of the two AC Output Legs (usually half of the FX's on each Leg). Connected between the AC Output Legs will be an X-240 autotransformer that gets installed in the PSAC (or PS2AC). The X-240 can perform two operations that a "classically" stacked system cannot perform and can handle more than two FX's. First, it can produce 240VAC from one Leg if that 240VAC load is small enough. This saves power in the long run by keeping the FX's on the other Leg in "sleep" mode. Secondly, the X-240 allows each FX to power loads on the Leg of which it is not directly connected. This allows the Master FX on Leg 1 to power loads on Leg 2 without "waking" and Slave FX's unnecessarily. The biggest advantage is that this system is very tolerant of imbalanced loads on the two 120 vac Legs on the AC output. By the magic of the X-240 autotransformer, together with the control method used in the FX, the AC loads are balanced on the two Legs automatically. This maximizes the efficiency of the FX system and allows larger loads to be operated without overloading one of the FX's. The AC Input source (generator or grid) must be 240VAC for both Legs to be powered and for no faults to occur.

**3-PHASE:** This stacking method pertains to a system that has three FX's connected to three 120VAC Output Legs that will produce 208VAC between any two Legs of the 3-phase system. In this stacking method only three FX's can be used. Each of the three FX's will be connected to its own 120VAC Output Leg. To set the system up properly an adjustment to the HUB is necessary. Within the HUB is a jumper that needs to be changed in order for the system to operate correctly. See the HUB manual for instructions on this procedure. The AC Input source (generator or grid) must be a 120VAC/208VAC 3-phase source connected to the AC Input terminals of the three FX's.

### X-240 AUTOTRANSFORMER CAPACITY

The X-240 autotransformer option is rated at 4000 VA continuously and consumes about 12 watts. The PSAC and PS2AC enclosures include mounting for this option and the PSAC (not the PS2AC) also includes a space to allow the addition of two 12 vdc powered 4 inch muffin fans to increase the continuous power rating of the X-240. This fan can be powered directly from the AUX output of an FX when the AUX output function has been programmed for "COOLFAN" (default) mode. This enables the 12 vdc fan to turn on automatically when the FX's are powering heavy loads. With the additional air flow on the X240, it can handle a maximum of 6000 VA continuously. The X-240 option includes a 25 amp, 2-pole circuit breaker which is rated for 100% continuous duty applications. It may be necessary to use two X-240's in systems that include more than four FX's (depending on how much power needs to be transferred from one AC Output Leg to the other AC Output Leg).

In the balancing transformer application with series stacked inverters, the X-240 is able to transfer up to 3000 VA from one of the 120 VAC output legs to the other 120 VAC output leg. Power higher than 3000 watts can be transferred through the X-240 for starting loads that require large surges but should not be used on a continuous basis.

## Stacking Procedure

This section will help inform you on how to set up stacking correctly and what the screens in the stacking menu mean. (Remember, for 3-phase stacking a jumper must be set to the 3-ph position in the HUB. See HUB manual for further information.) Make sure that the FX's connect to the lowest numbered ports of the HUB. First, turn off all AC breakers (the Bypass breaker can be left on). Next, turn on all FX's using their DC breakers and verify that the MATE recognizes all FX's. You can verify this by watching the MATE go through its boot-up sequence. The MATE's boot-up sequence will show the following screens: (1) "G'day Mate!" (2) "OutBack Power Systems" (3) Version (4) "HUB Found" (5) Hub ports and the OutBack devices connected to them. Screen (5) will allow you to verify that the MATE sees all of the FX's. If it doesn't see all of the FX's or if you aren't sure, you can do one of two things. Either disconnect and reconnect the MATE to the HUB or do a re-poll with the MATE. A re-poll on the MATE can be done by following the path **MAIN / SETUP / MATE / PG2 / COMM / RE POLL** (see the MATE manual for proper operation of the MATE). Once you are sure that the MATE recognizes all the FX's connected to the HUB, you must access the "STACK" menu. This can be found on the MATE by following the path **MAIN / ADV / any button (this screen serves as a warning only) / PASSWORD (press the INC and DEC buttons until the number is 141 and then press ENTER) / FX / PG2 / PG3 / STACK**. You are now in the menu used for stacking FX's. Before continuing we will inform you on what each screen pertains to, the possible selections of that screen and how to choose the next FX for proper programming.

### STACK PHASE

The "Stack Phase" screen establishes which FX is the master and which FX's follows the master's commands. Each FX has a default of "1-2ph Master" (one or two phase Master). The FX on port 1 of the HUB is always a Master (and usually the only Master), otherwise the MATE will give a communication error. For a single phase or split (two) phase system, the FX in port 1 of the HUB should remain a "1-2ph Master". For a 3-phase system, the FX on port 1 of the HUB must be changed to a "3ph Master" (this procedure will be explained soon). To select the next FX connected to the HUB, press the PORT button on the MATE. In the upper right-hand corner of the MATE's screen is the "port" indicator. It will display a "P" followed by a number indicating the port it is controlling (for example "P01" indicates port 1, the Master FX's port). Repeatedly pressing PORT on the MATE will cycle through the ports on the HUB that have FX's connected to them. Stop when you have reached a port that has an FX on it that needs to be a Slave. By pressing the INC (increase) and DEC (decrease) buttons on the MATE, you can select the proper type of Slave that is appropriate for your system. Below are the different selections in the STACK PHASE menu with a description of what they do.

**1-2 PH MASTER:** 1-2 PH MASTER is used for stand-alone (one) FX systems OR as the MASTER of a single phase or split phase system. Set the stack phase of the FX you want as the master to '1-2 PH Master' (if it isn't already) and make sure it is in port 1 of the HUB. It is acceptable to have every FX connected to the HUB be a "1-2ph Master". If this is the case, each FX must be connected to a separate AC Output Leg (both Hot and Neutral). The master FX is always considered to be the L1 phase.

**CLASSIC SLAVE:** If you have a system with two FX's that you wish to produce 240VAC with but without an X-240 autotransformer, set the stack phase of the FX you want as the slave to "Classic Slave" and make sure it is in port 2 of the hub. "Classic" stacking is meant for 120/240 vac systems where each FX handles their own 120 volt phase. The combination of the two FX's creates 240 volts to run 240 loads. If this FX is set to 'Classic Slave' then its output is 180 degrees out of phase from the master and is considered to be the L2 phase. Classic stacking can only stack two FX's and there is no load sharing which is possible with 'OutBack' stacking.

**OB SLAVE L1: Single Phase:** If you have a system with two to ten FX's and you wish to produce 120VAC on the same AC Output Leg, set the stack phase of the FX's you want as the slaves to "OB Slave L1" and make sure that they are in the lowest numbered ports of the HUB. "OB Slave L1" is used for FX's that run in parallel with the master. These FX's are considered the L1 phase. **Split Phase:** Alternately, if you have a system with two to ten FX's and an X-240 autotransformer and you wish to produce 120VAC on both AC Output Legs and also 240VAC between the two AC Output Legs then set the stack phase of the FX's you want as **parallel** slaves (Leg 1) to "OB Slave L1". Make sure the slave FX's are in the lowest numbered ports of the HUB. "OB Slave L1" is used for FX's that run in parallel with the master. OutBack's X-240 autotransformer must be included in the system to use the split-phase stacking option. This FX is considered the L1 phase.

**OB SLAVE L2:** If you have a system with two to ten FX's and an X-240 autotransformer and you wish to produce 120VAC on both AC Output Legs and also 240VAC between the two AC Output Legs then set the stack phase of the FX's you want as **series** slaves (Leg 2) to "OB Slave L2". Make sure the slave FX's are in the lowest numbered ports of the HUB. "OB Slave L2" is used for FX's that run in series with the master. OutBack's X-240 autotransformer must be included in the system to use this stacking option. This FX is considered L2 phase.

**3PH MASTER:** If you have a system with three (and only three) FX's and you wish to produce 120VAC on three AC Output Legs as well as 208VAC between each AC Output Leg, set the stack phase of the FX you want as the master to "3PH Master" and make sure it is in port 1 of the HUB. The 3-phase stacking is similar to "Classic" stacking in the sense that each FX acts independently and cannot help out other phases. The HUB also has a jumper on it that needs to be changed for 3-phase stacking (refer to the HUB manual). This FX is considered phase A.

**3PH SLAVE:** If you have a system with three (and only three) FX's and you wish to produce 120VAC on three AC Output Legs as well as 208VAC between each AC Output Leg, set the stack phase of the 2 FX's you want as the slaves to "3PH Slave" and make sure they are in ports 2 and 3 of the HUB. There are no selections to differentiate between phases B and C. When you set the jumper in the HUB for 3-phase, the HUB tells each slave which phase they are. "3PH slave" on HUB port 2 is considered phase B. "3PH slave" on HUB port 3 is considered phase C.

## Stacking Procedure (Continued)

The next two screens in the “Stack” menu on the MATE are the “POWER SAVE LEVEL **MASTER** ADJUST ONLY” and “POWER SAVE LEVEL **SLAVE** ADJUST ONLY” screen. You can access these screens by pressing DOWN once or twice if you are currently on the STACK PHASE screen. Since nobody (seriously, even here at OutBack) understands these screens the first 3-4 times they are explained, we offer our best effort right here. These screens only make complete sense after you’ve read and understand both of them. These two screens only pertain to systems that have “OB Slave L1” and “OB Slave L2” type slaves.

### POWER SAVE LEVEL MASTER ADJUST ONLY

Only adjust the value on this screen if you wish to have one or more of the Slave FX’s AC outputs “On” at all times. This may be necessary if you wish to have instantaneous power on Leg 2 or are having trouble starting large loads. The first thing to note is that this screen pertains to the Master FX only and therefore you must be on port 1 (P01 in the upper right-hand corner of the MATE). Press PORT on the MATE until you see P01 on the MATE. The number to the right of the screen is the “Slave Rank Designator”. The default value for the Slave Rank Designator is zero (0) on every FX. By pressing INC on the MATE you can increment (by whole numbers) this value. If this value is set to a number greater than zero then the Master FX will keep the Slave FX’s AC outputs “On” if they have a “POWER SAVE LEVEL **SLAVE** ADJUST ONLY” value equal to or less than this number (for instance, if this value is set to “2” then all the Slaves with “POWER SAVE LEVEL **SLAVE** ADJUST ONLY” values of “1” or “2” will have their AC outputs kept “On”). Any Slave with a “POWER SAVE LEVEL **SLAVE** ADJUST ONLY” value greater than the Masters “POWER SAVE LEVEL **MASTER** ADJUST ONLY” value will be “asleep” (AC output is “Off”) until the Master calls upon it to help with large loads.

### POWER SAVE LEVEL SLAVE ADJUST ONLY

This screen allows you to assign the “Slave Rank” of the Slave FX’s in the system. The first thing to note is that this screen pertains to the Slave FX’s only and therefore you must be on port 2 or greater on the MATE (shown in the upper right-hand corner of the MATE as P02 or P03, etc.). Press PORT on the MATE until you see the port that you wish to program displayed on the MATE. The number to the right of the screen is the “Slave Rank”. All Slave FX’s have “POWER SAVE LEVEL **SLAVE** ADJUST ONLY” (or “Slave Rank”) default values of 1. If this value is not changed from 1 then one of two things will happen. First, if the Master FX has been programmed with a value of 1 or greater in the “POWER SAVE LEVEL **MASTER** ADJUST ONLY” screen then all of the Slave FX’s (with “Slave Rank” = 1) will remain “On” at all times. Second, if the Master FX has been programmed with a value of zero in the “POWER SAVE LEVEL **MASTER** ADJUST ONLY” screen then all of the Slave FX’s will remain “Off” until the Master FX needs help and calls for the Slave FX’s with “Slave Rank” equal to 1 to come “On”. This will turn on all of the Slaves. If your system includes more than one Slave FX then will want to choose a different “Slave Rank” for each Slave FX. This allows them to come “On” one at a time which saves power in the long run. To change the “Slave Rank” of a given Slave FX, press the PORT button on the MATE until the Slave FX’s port appears in the upper right-hand corner of the MATE. Next, press INC to increase the value until it is what you desire. Repeat this process for each Slave in the system. When a Slave FX has a “POWER SAVE LEVEL **SLAVE** ADJUST ONLY” value greater than the Master FX’s “POWER SAVE LEVEL **MASTER** ADJUST ONLY” it will remain “Asleep” (and save about 18 watts). When large loads are present, the Master FX will call out for “Slave Rank” = 1 to come “On” (unless it is already “On” due to the “POWER SAVE LEVEL **MASTER** ADJUST ONLY” setting being 1 or greater). If the Master FX needs even more power then it will call out for “Slave Rank” = 2 to come “On” and so on.

Using these three screens will allow you to stack your system in many different configurations. As an addition to the explanations above, we have offered some examples of common systems outlined below.

## System Examples

### DUAL-STACKED SYSTEM USING “CLASSIC” STACKING

This type of system will include only two FX’s and must be set up as described here. Turn off all AC Output and AC Input breakers before powering up FX’s. In a dual stack, I am assuming that the top FX is plugged into port 1 of the HUB and the 2<sup>nd</sup> FX down is plugged into port 2 (the location of the FXs is not a rule, just for simplicity). Using the MATE, go to the stacking menu (explained earlier in the “Stacking Instructions” section). You are now at the 1<sup>st</sup> stacking menu called “Stack Phase”. In the upper right hand corner of the mate screen will always be the HUB port number of the FX you’re working with at the time. Let’s start out with the FX that’s on port 1. If something other than P01 appears in the upper right hand corner then press the PORT button until P01 appears. Set the “Stack Phase” of the port 1 FX to “1-2 PH Master”. Press the PORT button and verify that the label in the upper right hand corner displays P02. We are still in the “Stack Phase” menu but we are now talking to the FX on port 2. Push the INC button once to set the “Stack Phase” to “Classic Slave”. Now you’ve set 1 FX (P02) to be in series with the master (P01). The next two screens in the STACK menu do not apply to a Classically stacked system, so you need not worry about them. Have fun with your system!

### STACKED SYSTEM USING OUTBACK’S “PARALLEL” STACKING

This type of system may have between 2 and 10 FX’s that will have their AC Outputs connected to the same Leg. We will be using a Quad-Stacked (4 FX) system as an example. If you have less than four FX’s then any reference to FX’s on ports greater than the amount of FX’s in your system will not apply to your system. If you have more than four FX’s then follow the natural pattern of programming that will become apparent in this example.

In a quad stack, I am assuming that the top FX is plugged into port 1 of the HUB, the 2<sup>nd</sup> FX down is plugged into port 2, the 3<sup>rd</sup> FX down is plugged into port 3, and the 4<sup>th</sup> FX down is plugged into port 4 (again, location of the FXs is not a rule, just for simplicity).

## System Examples (Continued)

Using the MATE, go to the stacking menu (explained earlier in the “Stacking Instructions” section). You are now at the 1<sup>st</sup> stacking menu called “Stack Phase”. In the upper right hand corner of the mate screen will always be the HUB port number of the FX you’re working with at the time. Let’s start out with the FX that’s on port 1. If something other than P01 appears in the upper right hand corner then press the PORT button until P01 appears. Set the “Stack Phase” of the port 1 FX to “1-2 PH Master”. Press the PORT button and verify that the label in the upper right hand corner displays P02. We are still in the “Stack Phase” menu but we are now talking to the FX on port 2. Push the INC button two times to set the “Stack Phase” to “OB Slave L1”. Press the PORT button again to talk to the FX on port 3. Push the INC button two times to set the “Stack Phase” to “OB Slave L1”. Press the PORT button again to talk to the FX on port 4. Push the INC button two times to set the “Stack Phase” to “OB Slave L1”. Now you’ve set 3 FX’s (P02-P04) to be in parallel with the master (P01). If you have more FX’s in the system then program them as “OB Slave L1”.

Press the DOWN button 2 times to get into the “POWER SAVE LEVEL **SLAVE** ADJUST ONLY” menu. Press the PORT button until P02 is displayed in the upper right corner of the screen. This menu pertains to the slaves only which is why we’re starting out with port 2. The setting from the factory should be already set to 1 which is the 1<sup>st</sup> rank slave. If it’s anything other than 1 appears press the INC or DEC buttons to make it 1. Press the PORT button to talk to the port 3 FX. Press the INC button to change the “power save level slave adjust only” to 2 which is the 2<sup>nd</sup> rank slave. Press the PORT button to talk to the port 4 FX. Press the INC button until the setting is 3 for 3<sup>rd</sup> rank slave. Now you’ve set the rank for all the slaves. If you have more FX’s in the system then press the PORT button to access the next FX and press INC until the number on the screen is 1 number less than the port number (i.e. if you are on P05, the number on the screen should be 4).

Let’s back track a little by going to the “POWER SAVE LEVEL **MASTER** ADJUST ONLY” menu. Do this by pressing the DOWN button, TOP button, then DOWN button. Verify that the screen you are on now is the “POWER SAVE LEVEL **MASTER** ADJUST ONLY” screen and change the port to P01. Turn on all of your FX’s AC Output breakers. The master FX’s “Inverter” LED should be solid and all the slaves “Inverter” LED’s should be blinking. Adjust the “POWER SAVE LEVEL **MASTER** ADJUST ONLY” from 0 to 1 and watch the 1<sup>st</sup> slave’s “Inverter” LED go solid. When the “Inverter” LED is on solid, this means that the inverter is on. When the “Inverter” LED on the slave is blinking, this means the FX is asleep. Adjust the “POWER SAVE LEVEL **MASTER** ADJUST ONLY” to 2 and watch the 2<sup>nd</sup> slave’s “Inverter” LED turn on. Adjust the “POWER SAVE LEVEL **MASTER** ADJUST ONLY” to 3 and watch the 3<sup>rd</sup> slave’s “Inverter” LED turn on. If you have more than three slaves then keep increasing the value in the “POWER SAVE LEVEL **MASTER** ADJUST ONLY” screen and verify that each slave’s “Inverter” LED comes on as expected. You have now verified that all FX’s are stacked correctly so adjust the “POWER SAVE LEVEL **MASTER** ADJUST ONLY” back down to 0 and have fun with your system!

## STACKED SYSTEM USING OUTBACK’S “SERIES / PARALLEL” STACKING

This type of system may have between 2 and 10 FX’s that will have their AC Outputs connected to one of two Legs. I am assuming that half of the FX’s will be connected to each AC Output Leg. Actually, it is acceptable to divide the FX’s between the two Legs in the way you see fit, but at least one FX must be on each Leg. We will be using a Quad-Stacked (4 FX) system with two FX’s on each Leg in this example. When we set an FX as “OB Slave L1” this indicates that it is in parallel (on the same Leg) with the master FX. When we set an FX as “OB Slave L2” this indicates that it is in series (on the opposite Leg) with the master FX. If you have a different amount of FX’s than the four FX’s in our example or if you are overloading one Leg of your system, then you might be putting the slave FX’s on different Legs than what is shown in the example. We will try to alleviate any confusion when we get to the part of the process where this is important. The sentences in *italics* are intended for instructions on systems that are different than the example.

In a quad stack, I am assuming that the top FX is plugged into port 1 of the HUB, the 2<sup>nd</sup> FX down is plugged into port 2, the 3<sup>rd</sup> FX down is plugged into port 3, and the 4<sup>th</sup> FX down is plugged into port 4 (again, the location of the FXs is not a rule, just for simplicity). Using the MATE, go to the stacking menu (explained earlier in the “Stacking Instructions” section). You are now at the 1<sup>st</sup> stacking menu called “Stack Phase”. In the upper right hand corner of the mate screen will always be the HUB port number of the FX you’re working with at the time. Let’s start out with the FX that’s on port 1. If something other than P01 appears in the upper right hand corner then press the PORT button until P01 appears. Set the “Stack Phase” of the port 1 FX to “1-2 PH Master”. Press the PORT button and verify that the label in the upper right hand corner displays P02. We are still in the “Stack Phase” menu but we are now talking to the FX on port 2. Push the INC button two times to set the “Stack Phase” to “OB Slave L1”

*If you have a system with only two FX’s or you wish to put the FX connected to port 2 in series with the master, push the INC button one additional time (three times total) to set the “Stack Phase” to “OB Slave L2”.*

Press the PORT button again to talk to the FX on port 3. Push the INC button three times to set the “Stack Phase” to “OB Slave L2”

*If you wish to put the FX connected to port 3 in parallel with the master, push the INC button only two times to set the “Stack Phase” to “OB Slave L1”.*

Press the PORT button again to talk to the FX on port 4. Push the INC button three times to set the “Stack Phase” to “OB Slave L2”.

*Again, if you wish to put the FX connected to port 3 in parallel with the master, push the INC button only two times to set the “Stack Phase” to “OB Slave L1”. Any additional FX’s in the system can be programmed by pressing the PORT button to get to the next FX and then press INC two times (“OB Slave L1”) for parallel stacking or press the INC button three times for series stacking. In this example, we’ve set 1 FX (P02) to be in parallel with the master (P01) and 2 FX’s (P03 & P04) to be in series with the master.*

Press the DOWN button 2 times to get into the “POWER SAVE LEVEL **SLAVE** ADJUST ONLY” menu. This menu allows you to set the order in which the slave FX’s come “On”. Press the PORT button until P03 is displayed in the upper right corner of the screen. We’re starting out with port 3 because the FX on port 3 is the first slave that is in *series* (“OB Slave L2”) with the master.

## System Examples (Continued)

By making this FX the 1<sup>st</sup> rank slave, we are turning both Legs “On” directly, thus producing 240VAC without using the X-240.

*If you have a system that is different from this example then press the PORT button until you get to a slave FX that is in series (“OB Slave L2”) with the master.*

On this screen the setting from the factory should be set to 1 which indicates the 1<sup>st</sup> rank slave. If it's anything other than 1 then press the DEC button until it becomes 1. Press the PORT button until you reach P02 to talk to the port 2 FX.

*If you have a system that is different from this example then press the PORT button until you get to a slave FX that is in parallel (“OB Slave L1”) with the master.*

Press the INC button to change the “POWER SAVE LEVEL **SLAVE ADJUST ONLY**” to 2 which is the 2<sup>nd</sup> rank slave. Press the PORT button twice to talk to the port 4 FX.

*If you have a system that is different from this example then press the PORT button until you get to the next slave FX that is in series (“OB Slave L2”) with the master.*

Press the INC button until the setting is 3 for 3<sup>rd</sup> rank slave.

*Any additional FX's in the system can be programmed by pressing the PORT button to get to the next FX and then press INC until the setting is 4 for the 4<sup>th</sup> rank slave. Continue this process, making sure each FX has its own “Slave Rank”, until you have set all FX's.*

Let's back track a little by going to the “POWER SAVE LEVEL **MASTER ADJUST ONLY**” menu. Do this by pressing the DOWN button, TOP button, then DOWN button. Verify that the screen you are on now is the “POWER SAVE LEVEL **MASTER ADJUST ONLY**” screen and change the port to P01. Turn on all of your FX's AC Output breakers. The master FX's “Inverter” LED should be solid and all the slaves “Inverter” LED's should be blinking. Adjust the “POWER SAVE LEVEL **MASTER ADJUST ONLY**” from 0 to 1 and watch the 1<sup>st</sup> slave's (port 3) “Inverter” LED go solid. When the “Inverter” LED is on solid, this means that the inverter is on. When the “Inverter” LED on the slave is blinking, this means the FX is asleep. Adjust the “POWER SAVE LEVEL **MASTER ADJUST ONLY**” to 2 and watch the 2<sup>nd</sup> slave's (port 2) “Inverter” LED turn on. Adjust the “POWER SAVE LEVEL **MASTER ADJUST ONLY**” to 3 and watch the 3<sup>rd</sup> slave's (port 4) “Inverter” LED turn on. If you have more than three slaves then keep increasing the value in the “POWER SAVE LEVEL **MASTER ADJUST ONLY**” screen and verify that each slave's “Inverter” LED comes on as expected. You have now verified that all FX's are stacked correctly so adjust the “POWER SAVE LEVEL **MASTER ADJUST ONLY**” back down to 0 and have fun with your system!

### 3-PHASE STACKED SYSTEM (3 FX'S ONLY)

This type of system will include only three FX's and must be set up as described here. Turn off all AC Output and AC Input breakers before powering up FX's. In 3-phase stacking, I am assuming that the top FX is plugged into port 1 of the HUB, the 2<sup>nd</sup> FX down is plugged into port 2 and the 3<sup>rd</sup> FX down is plugged into port 3 (This is not a rule, just for simplicity). The HUB has a jumper on it that needs to be changed for 3-phase stacking (refer to the HUB manual). Using the MATE, go to the stacking menu (explained earlier in the “Stacking Instructions” section). You are now at the 1<sup>st</sup> stacking menu called “Stack Phase”. In the upper right hand corner of the mate screen will always be the HUB port number of the FX you're working with at the time. Let's start out with the FX that's on port 1. If something other than P01 appears in the upper right hand corner then press the PORT button until P01 appears. Set the “Stack Phase” of the port 1 FX to “3ph Master”. The Master FX is considered phase A. Press the PORT button and verify that the label in the upper right hand corner displays P02. We are still in the “Stack Phase” menu but we are now talking to the FX on port 2. Push the INC button five times to set the “Stack Phase” to “3ph Slave”. Now you've set this FX (P02) as phase B, producing 208VAC between itself and the master (P01). Press the PORT button again and verify that the label in the upper right hand corner displays P03. We are still in the “Stack Phase” menu but we are now talking to the FX on port 3. Push the INC button five times to set the “Stack Phase” to “3ph Slave”. Now you've set this FX (P03) as phase C, producing 208VAC between itself and the master (P01) and also 208VAC between itself and the FX on phase B. The next two screens in the STACK menu do not apply to a 3-phase system, so you need not worry about them. Remember that the AC input to a 3-phase system must be a 3-phase source (generator or grid). Have fun with your system!

# AUTOMATIC GENERATOR START INSTRUCTIONS

The Aux output of the FX can be programmed to start a 2-wire gas or diesel generator automatically when the batteries need charging. There are two separate ways to accomplish this function; **AGS (Advanced Generator Start)** and **GenAlert**. AGS is a function of the MATE while GenAlert is a function of the FX.

**AGS** has more features and therefore it can start the generator under many different types of conditions. The AGS features include Quiet Time, Voltage Start, Load Start, Must Run, and Exercise. Since AGS is a function of the MATE see the MATE manual for instructions. **NOTE:** The MATE must have a Code revision of 3.30 or greater (found on the third start-up screen of the MATE).

**GenAlert** is another way to automatically start the generator. It is programmed through the MATE but it doesn't have all of the features that AGS has. It works on a voltage start system where the generator will start when the battery voltage reaches a certain voltage for a specific period of time and stop when the battery voltage reaches a higher voltage for a different period of time. These voltages and time periods are programmed through the MATE. If you wish to use the GenAlert option, follow the instructions below. **NOTE:** If both AGS and GenAlert are programmed, AGS will be used.

Starting from the main menu, press the **<ADV>** button to get into the advanced menu (the "password" is **141**, press **<INC>** until the number reads 141 and then press **<ENTER>**). From the Advanced menu press the **<PG2>** button then the **<PG3>** button, then the **<AUX>** button to get into the auxiliary menu. The first screen that comes up is the "aux output control" which tells the FX to keep the aux output off, on, or automatically do what the auxiliary output function is. In this case we want to keep the default setting on "AUTO".

Press the **<DOWN>** button to get into the "aux output function" menu. This is the menu where we tell the auxiliary output what function we want it to be. In this case we want it to start a generator. The default setting is "CoolFan" so press the **<DEC>** button 3 times so the display reads "GenAlert". Now that the function is set to start a 2-wire start generator, the start and stop parameters need to be set.

Press the **<DOWN>** button to get into the "genalert on setpoint" menu. This menu adjusts the battery voltage set point to where you want the generator to start at. The default setting is 11, 22, or 44 volts (depending on your FX) which you can adjust. Press the **<INC>** or **<DEC>** buttons to change this setting.

Press the **<DOWN>** button to get into the "genalert on delay" menu. This menu adjusts the time you will allow the battery to be at the "genalert on setpoint" voltage before starting the generator. The default setting is 4 minutes at the "genalert on setpoint" and the generator will start. Press the **<INC>** or **<DEC>** buttons to change this setting.

Press the **<DOWN>** button to get into the "genalert off setpoint" menu. This menu adjusts the battery voltage set point to where you want to stop the generator. The default setting is 14, 28, or 56 volts (depending on your FX) which you can adjust. Press the **<INC>** or **<DEC>** buttons to change this setting.

Press the **<DOWN>** button to get into the "genalert off delay" menu. This menu adjusts the time you will allow the battery to be at the "genalert off setpoint" before stopping the generator. The default setting is 9 minutes at the "genalert off setpoint" and the generator will stop. Press the **<INC>** or **<DEC>** buttons to change this setting.

Even though you have set the off function for the generator, there are two other ways that the auxiliary output can stop the generator. If the charger settings of the FX reach float or silent mode, that overrides the "genalert off setpoint" because the FX figures that the batteries are charged. The generator will turn off based on whatever comes first, genalert off, float, or silent. If you want to stop the generator based on float or silent, either extend the "genalert off delay" beyond what is capable of the charger to achieve or raise the "genalert off setpoint" higher than the "absorb setpoint" (default of 14.4, 28.8, or 57.6 volts depending on your FX).

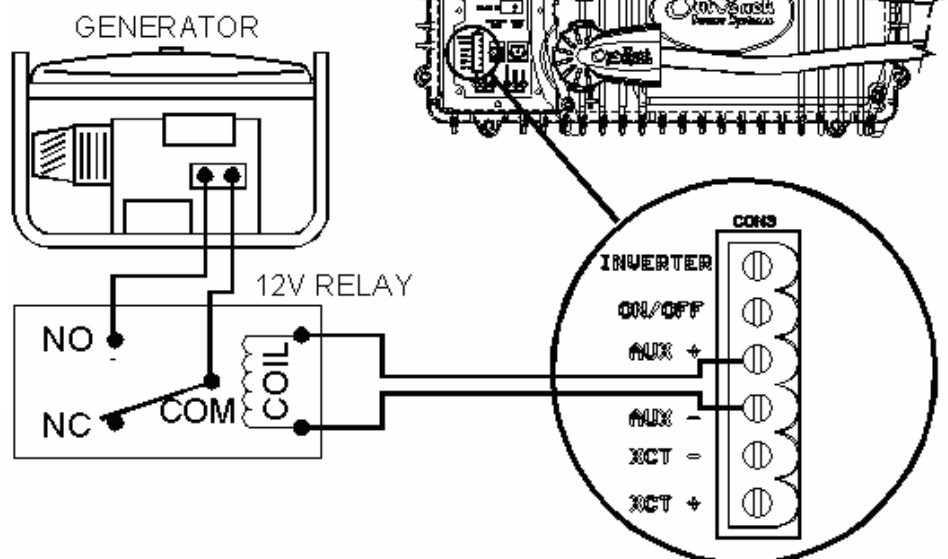
The following schematic shows how to hook up a relay that interfaces with the 2-wire start generator. 3-wire start generators require an adapter like the Atkinson GSCM available at: [www.atkinsonelectronics.com](http://www.atkinsonelectronics.com).

Here are a couple of relays to use.  
Most 12V relays will work of generator starting. Select one between 2 and 30 amp contacts.

- 1) Radio Shack SPST 30 amp Auto Relay #275-226
- 2) Grainger 10 amp SPDT relay #5ZH14  
MFR: Omron #G2R-1-S-DC12

The socket for this relay is....  
Grainger #6C898  
MFR: Omron #P2RF-05-E

## TWO WIRE START GENERATOR HOOK UP



# General

## GROUND SWITCHING

How it works: With no AC input signal present, the FX inverter's Neutral Output is tied to Chassis Ground and hence to the Boat or RV Ground. This is similar to any Home installation where one conductor (Neutral for the US) must be grounded. When an AC input is applied and the inverter allows it to transfer, the Neutral Output to Ground bond within the inverter is broken. The Neutral Output line is then connected to the Input's Neutral and also the Ground of the Input source. At this point the FX inverter is using the Ground supplied by shore power or the generator as its Neutral to Ground bond and this Ground becomes the inverters Ground.

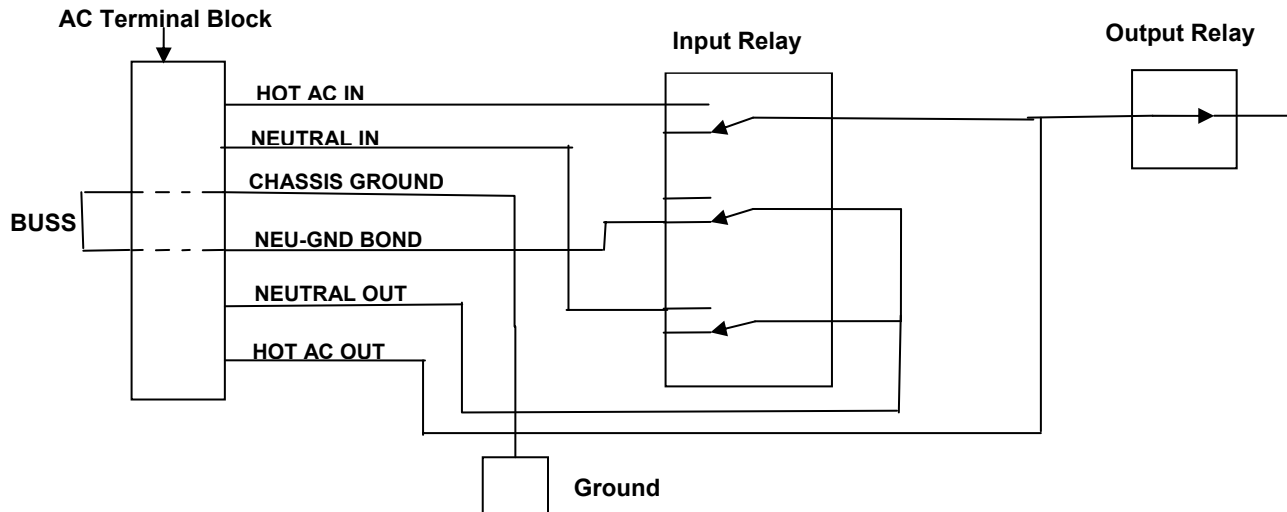
## STACKING MOBILE FX INVERTER/CHARGERS

The Master will be configured normally where the AC Input's Ground is connected to the bussed GND-NEU connection of the FX inverter. The slave inverters must have the buss removed and the Ground of the AC Input must be connected directly to the Chassis Ground of the inverter. The reason for this configuration is that if each inverter has a bussed Neutral to Ground bond and any inverter transfers sooner than the rest, the remaining inverters will have a different Neutral to Ground bond (One to the mobile Ground rather than shore Ground). In this case there will be multiple Neutral to Ground bonds and the GFP breaker may blow if a noticeable voltage is present. By removing the Neutral to Ground buss this problem is eliminated.

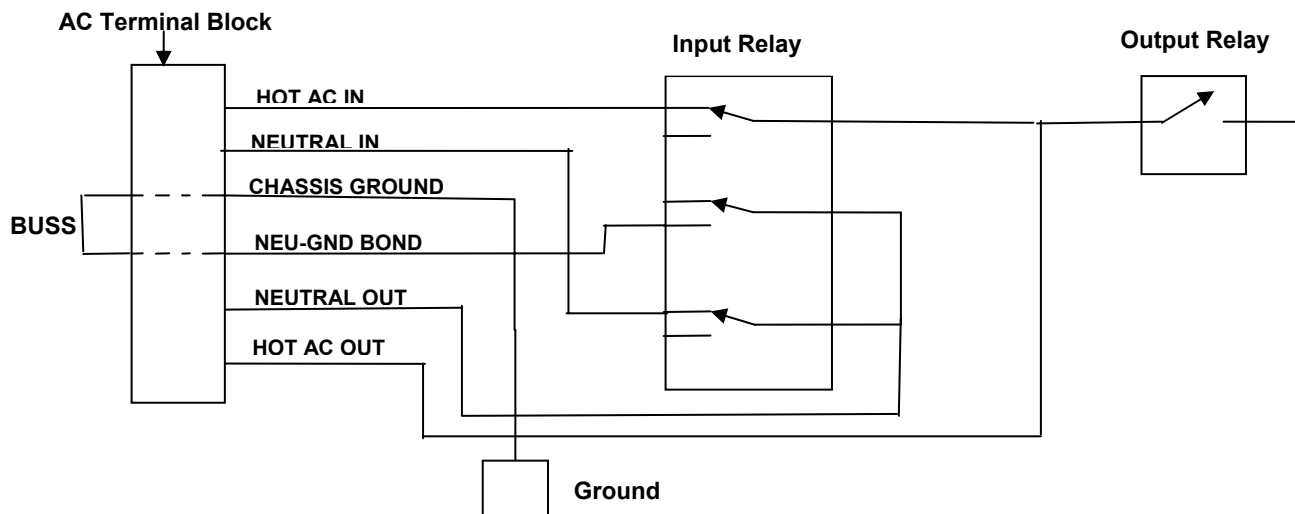
## MAXIMUM AC INPUT CURRENT

Mobile FX inverterchargers limit the AC input current to 30 amps. Outback Power has decided to do this because they use only one of the three poles of the input relay within the FX. In a non-mobile FX, all three poles are used and can therefore carry three times the current (theoretically, since they are paralleled this limit decreases). The mobile FX uses two poles of this relay for ground switching, so only one pole is available. Due to this fact, we recommend a 30 amp breaker for the AC input to the FX.

### Relay Diagram with AC Input Not Connected



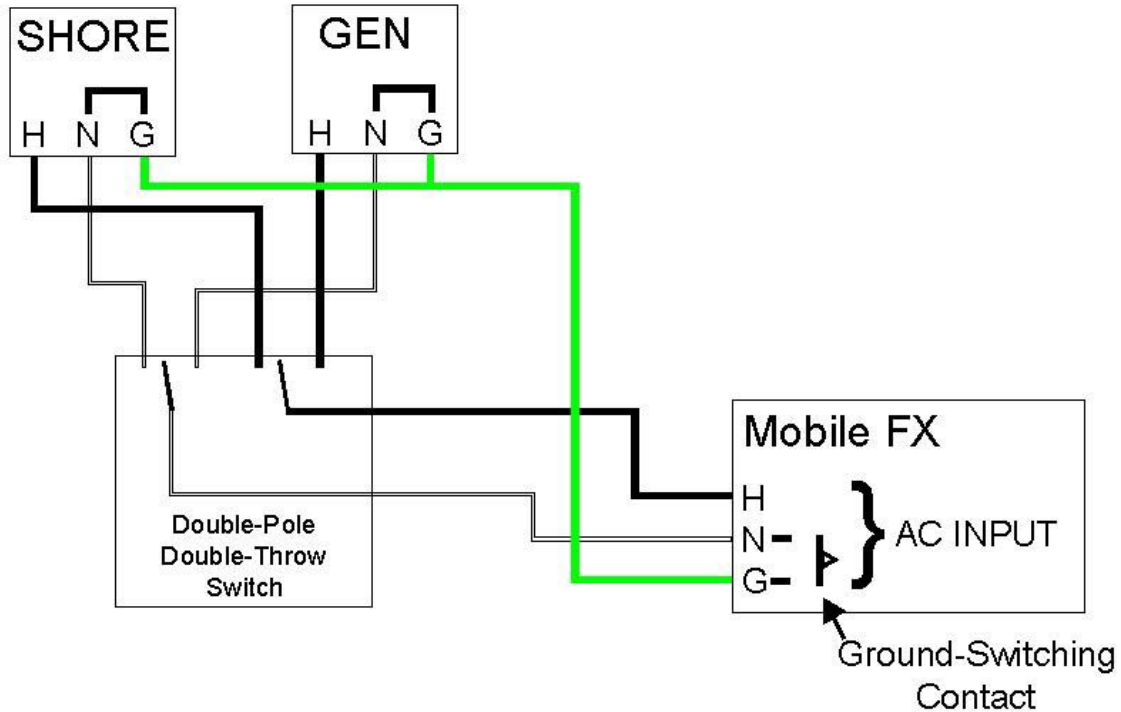
### Relay Diagram with Ground Switched (Connected to Utility/Shore Power Neutral and Ground)





## Dual Input Transfer Switch Setup

In many cases, systems will have the option of using either an onboard generator or the utility grid (shore power) as their AC input. When this is the case, both the AC “Hot” and AC “Neutral” lines must be connected to the appropriate source. Currently, OutBack Power Systems does not produce a product that will accomplish this function. Therefore, the consumer must purchase a device that accomplishes this task. The simplest form of this device is a double-pole, double-throw switch. The words “double-pole” indicates that there are two connections, one for AC “Hot” and one for AC “Neutral”. The words “double-throw” indicate that there are two sets of poles that can be contacted. This switch must be rated to handle the maximum AC voltage and AC current that it will see. When using a “Mobile” FX with an onboard generator and a connection that can be made to “shore power”, refer to the diagram below. The “Mobile” FX’s AC input consists of a Hot (H), Neutral (N) and Neu/Ground Bond (G). The “Mobile” FX has an internal “Ground-Switching Contact” that will open when it connects to an AC input. This allows the FX to make the neutral-ground bond when an AC input is not connected yet, when an AC input connects, the neutral-ground bond will be released by the FX and made by the AC input. If the system is 120/240 VAC with 120/240 VAC inputs, a Triple-Pole Double-Throw Switch is required.



## **MATE - SYSTEM CONTROLLER AND DISPLAY**

The OutBack MATE system controller and display allows you to program, control, and monitor the operation of one or more FX's as well as any other OutBack products (such as the MX60 MPPT charge controller).

When connecting a MATE to more than one product is required, a HUB-4 or HUB-10 communication manager must be included in the system. The MATE can be located up to 1000 feet (300 meters) from the FX system using standard 8 conductor CAT-5 type communication cabling. This wiring is considered to be a low voltage / limited energy circuit.

The MATE can be used to program the FX and then removed in most cases. There are, however, some settings that are located within the MATE itself. Settings that require the use of the MATE's time and date (programmable through the MATE) are stored within the MATE and, therefore, the MATE must be connected to the FX or HUB for these setting to work. All of the settings pertaining only to the FX are stored in non-volatile memory inside of the FX itself. The battery can then be disconnected from the FX and the settings will not be lost.

The MATE also allows for monitoring and control of the FX system's operation. Some of the more advanced system operating modes (such as the *HIGH BATTERY TRANSFER (HBX)* function, the *ADVANCED GENERATOR START (AGS)* function and the *GRID USE* function) requires that a MATE be connected to the FX system all of the time. To use these functions properly, the MATE's time and date should be set. The MATE's settings are also stored in non-volatile memory and a battery within the MATE keeps the time and date current when disconnected from an FX or the HUB.

The operating software used in the MATE is upgradeable to allow for the addition of new features to existing systems. It can be easily removed and exchanged by the system user.

The MATE includes an RS-232 PC serial communication port to allow monitoring and remote modem access of the system via phone or internet. This PC software is currently being developed by third party companies and will soon be offered as an option through your OutBack Power Systems dealer. Tracking software is available at [www.RightHandEng.com/OutBack](http://www.RightHandEng.com/OutBack).

### **Outback Power Systems currently offers the following different versions of the MATE:**

"MATE": Basic MATE with an oval encasing shown below. The casing is grayish white in color. This option includes an RS-232 port.

"MATE2": Black flush mount version of the MATE shown below. This option includes an RS-232 port.

"MATE2M": Black flush mount version with a simplified menu designed specifically for the Mobile market. Includes RS-232 access.

### **OutBack MATE System Controllers**



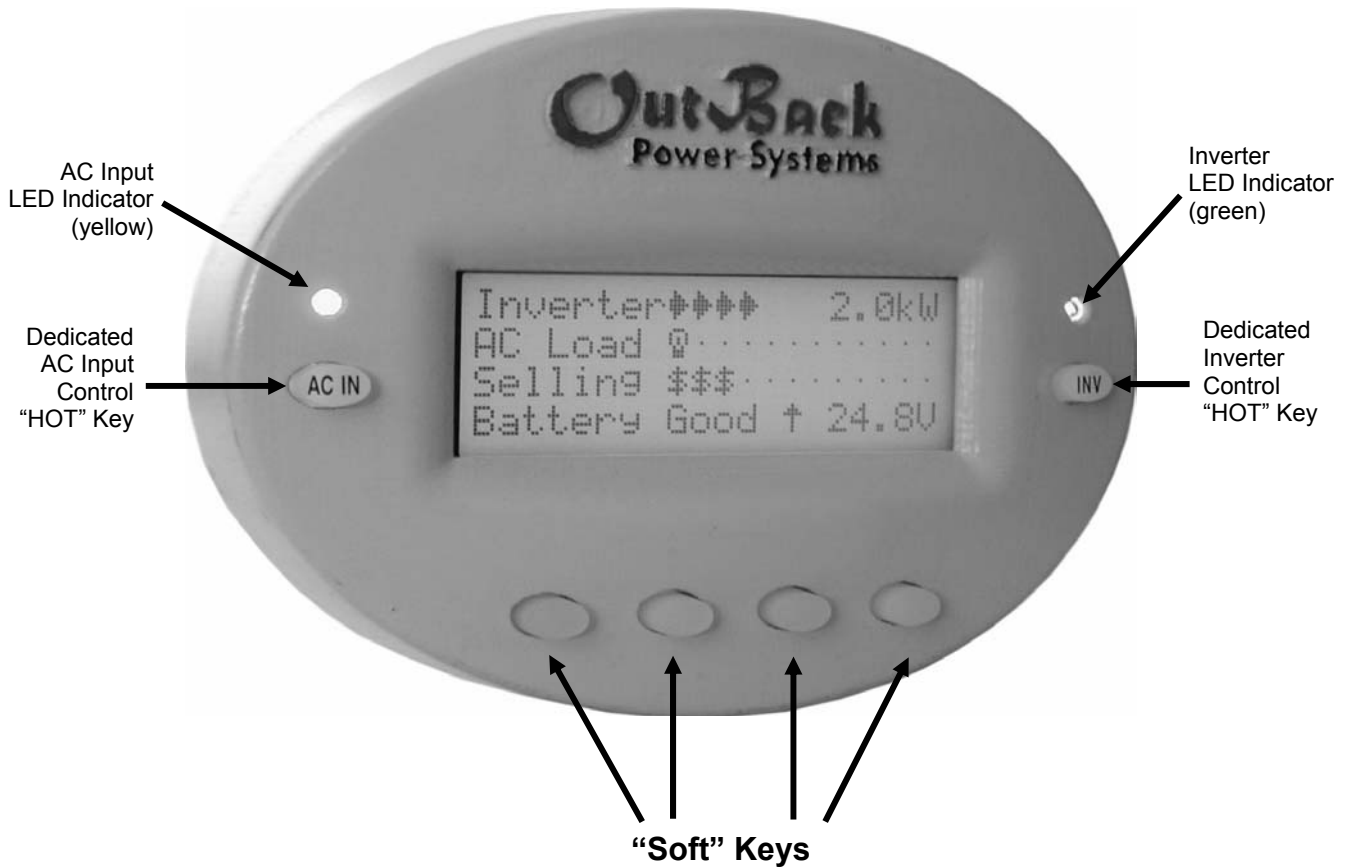
**"MATE"**



**"MATE 2" & "MATE 2M"**

# OUTBACK MATE

## System Controller and Display



*Each one of the soft keys corresponds to a word on the bottom line of the LCD display*

The menu system displayed on the MATE will vary depending on the software version that the MATE was programmed with at the time of manufacturing or during its last software upgrade. For your particular menu system, consult your MATE manual.

The following pages show the portion of the menu structure that relates to the FX. Most of the menu will be consistent no matter what type of FX you have purchased. The MATE displays that follow are from the most current MATE being sold by OutBack Power Systems.

The *DC voltage* values (the letters "vdc" usually follow these values) shown in the following MATE displays will be the default values for a 12V version of the FX. For the 24V version, multiply these values by 2. For the 48V version, multiply these values by 4. This multiplication process must be performed for the incremental values as well. When changing a voltage setting you will use the 'increment' (INC) or 'decrement' (DEC) buttons. For example, for a 12V FX the increment value is 0.1V. A 24V FX has an incremental value of 0.2V and a 48V FX has an incremental value of 0.4V.

All values displayed in the "Setup" and "Advanced" menus are the default values unless otherwise stated.

For "M" versions of the MATE (example: MATE 2"M"), only the "Status" and "Advanced" menus are the same as non-"M" versions of the MATE. If you are using an "M" version of the MATE, please consult the MATE manual for proper navigation and screen information.

# MATE – SYSTEM CONTROLLER AND DISPLAY

This section of the manual will cover how to use the buttons on the MATE to navigate the menus.

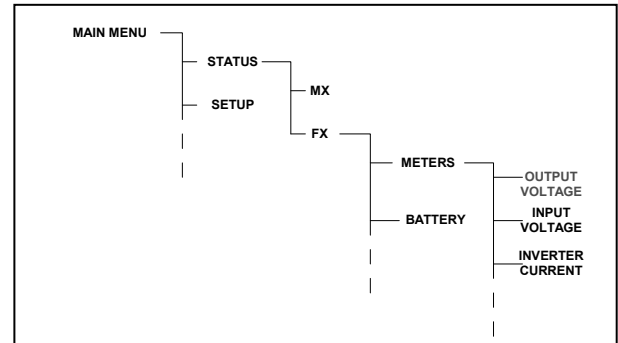
**NOTE:** The menu system displayed on the MATE will vary depending on the software version that the MATE was programmed with at the time of manufacturing or during its last software upgrade.

## MENU STRUCTURE

The OutBack MATE uses a branching menu structure to display various OutBack products operation modes and status. The menus are divided by product type and are categorized by type of setting or by information being displayed.

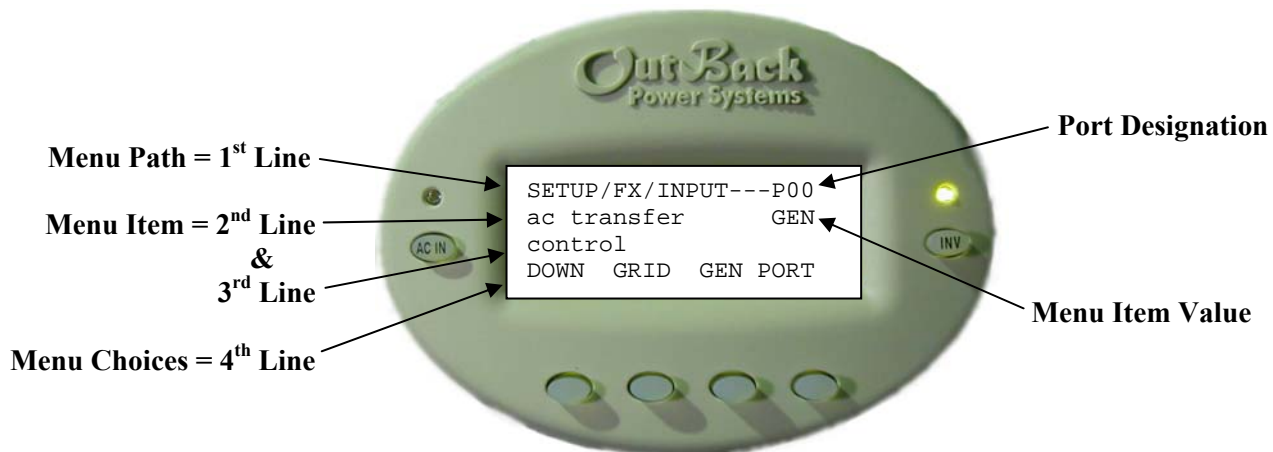
An example of the menu structure is shown to the right. All the screens that show AC meters are grouped together in one menu tree allowing the user to find the required meter with a minimum of button presses.

The top line of the MATE display will show the 'path' to the current menu; in this example it is STATUS/FX/METERS.



STATUS/FX/METERS-----
output 120 vac
voltage
DOWN UP TOP PORT

## MATE BUTTONS



The MATE uses a six button user interface to navigate the menus and to change set points of various OutBack products.

Two buttons are dedicated to the FX and are labeled **AC IN** and **INV**. These buttons are special in that they can be pressed at any time anywhere in the MATE menu structure, and they take you to the same screens. For this reason they are referred to as 'Hot' keys. Many common functions that need to be accessed often are found under the **AC IN** and **INV** button.

The four lower buttons under the LCD are called 'soft' keys and are used for navigating around the menus and changing values. Each 'soft' key has various functions dependent on the label directly above it on the lower line of the LCD.

The 1<sup>st</sup> line on the MATE usually displays the path or location of where you are in the menu system. The 2<sup>nd</sup> and 3<sup>rd</sup> lines of the MATE usually give you a description of what meter is being displayed or what parameter is currently set in the MATE. The words to the left of the 2<sup>nd</sup> and 3<sup>rd</sup> lines should be read together while ignoring the "Menu Item Value" to the right. For instance, the parameter on the above MATE screen should be read "**ac transfer control**" whose value is **GEN**. The 4<sup>th</sup> line on the MATE is almost exclusively used for labels to the four soft keys below. Each button below the 4<sup>th</sup> line of the MATE's display corresponds to the word directly above it.

This manual will denote soft key button presses as **<BUTTON>**, where **BUTTON** corresponds with the label displayed on the screen directly above the soft key.

**NOTE: Pressing the left two buttons simultaneously from anywhere in the menu will return you to the MAIN menu screen.**

## ‘SOFT’ KEYS

The four buttons under the LCD are referred to as the ‘soft’ keys. Their operation is dependent on what their label says. The label is the word on the bottom line of the LCD directly above the button.

Soft keys used to navigate the menus are commonly labeled <UP>, <DOWN>, <NEXT>, <BACK>, or <TOP>.

Soft keys that change settings are labeled either with the change they will make, such as : <OFF>, <AUTO>, and <ON>, or if there are more than a couple values that the setting can be changed to, <INC> and <DEC> are used to mean *increase* and *decrease*, respectively.

```
SETUP/FX/INPUT---P00
ac transfer      GEN
control
DOWN  GRID GEN  PORT
```

In this example, pressing <DOWN> will take you to the next set point screen in the SETUP/FX/INPUT menu.

```
SETUP/FX/INPUT---P00
Input setup
completed
TOP  SETUP  MAIN
```

In this example, pressing <TOP> will take you to the first screen in the SETUP/FX/INPUT menu. <SETUP> will return you to the SETUP/FX screen, and <MAIN> will take you back to the Main screen.

```
SETUP/FX/INPUT---P00
ac transfer      GEN
control
DOWN  GRID GEN  PORT
```

In this example, pressing <GRID> will change the FX AC transfer control to **GRID** mode. Conversely, pressing <GEN> will change the FX AC transfer control to **GEN** mode.

```
SETUP/FX/INPUT---P00
ac1/grid      60.0 aac
limit
DOWN  INC  DEC  PORT
```

In this example, pressing <INC> or <DEC> will change the numerical value of the **ac1/grid limit** setting.

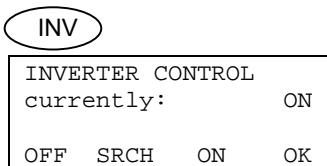
```
ADV/FX/AUX-----P00
aux output    CoolFan
function
DOWN  INC  DEC  PORT
```

In this example, there are multiple operating modes for the aux output function. Pressing <INC> or <DEC> will cycle through the available modes.

## Inverter Control



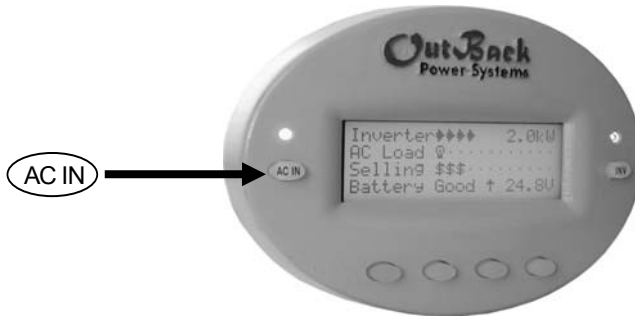
The OutBack MATE includes an **INV** “hot” key to allow direct control of the inverter from anywhere in the menu system. The INV key is located on the right side of the MATE LCD display. Pressing the INV key takes you to the INVERTER CONTROL menu shown below. A green LED indicator is located above the INV key which flashes when the inverter is either in the search or power save modes and is on continuously when full AC output voltage is available from the inverter. When the inverter is turned off the green LED will not be illuminated.



Pressing the **INV** key once brings up the INVERTER CONTROL screen. To turn the inverter ON, press the key located below the word ON. Selecting SRCH will cause the inverter to begin operating in the search mode as long as the AC load connected is smaller than allowed by the programming of the search function. Selecting OFF turns off the inverters AC output signal.

Select OK to return to the point in the menu system from where you entered the INVERTER CONTROL screen.

# AC Input Control



The OutBack MATE includes a **AC IN** “hot” key to allow direct control of the AC input from anywhere in the menu system. The AC IN key is located on the left side of the MATE’s LCD display. Above the AC IN key is a yellow LED indicator which flashes when an AC source is available but not connected, and is on continuously when the AC source is connected. If no AC source is available the yellow LED indicator will remain off. The screens shown on this page apply to the “MATE”, the “MATE B” and the “MATE 2” only.

AC IN

AC INPUT CONTROL		
currently:	USE	
DROP	USE	OK

Pressing the **AC IN** key once brings up the AC INPUT CONTROL screen. USE enables the inverter to connect to the AC source when it is available. DROP disconnects the AC source but will allow it to be reconnected if the battery gets too low or the inverter is overloaded.

AC IN AC IN

GEN START CONTROL			
currently:	MAN-OFF		
OFF	AUTO	ON	OK

Pressing the **AC IN** key a second time brings up the GEN START CONTROL screen. This allows operation of the generator either manually or automatically using the Advanced Generator Start (AGS) functions. The generators starting circuitry must be connected to the AUX ports of the control terminal block (see pages 11 & 12) to use this screen to manually turn the generator ON or OFF or to let the FX automatically perform the AGS functions. When the AGS functions have not been programmed, the screen will show MAN-OFF indicating that the generator is controlled manually and is OFF. Pressing the ON button will change the screen into MAN-ON and the generator will turn ON. To put this screen in AUTO mode, you must access the AGS SETUP menu. See your MATE manual for details.

AC IN AC IN AC IN

CHARGER CONTROL		
currently:	AUTO	
OFF	AUTO	OK

Pressing the **AC IN** key a third time brings up the CHARGER CONTROL screen. This allows operation of the battery charger to be preset for when an AC source is available. In AUTO mode the charger will start charging when an AC source connects to the FX or when the FX decides the batteries need charging. In OFF mode the charger stays off but the AC source is still passed through to the loads.

AC IN AC IN AC IN AC IN

CHARGER MODE CONTROL		
global charger mode		
BULK	EQ	OK

Pressing the **AC IN** key a fourth time brings up the **CHARGER MODE CONTROL** screen. This screen allows the MATE to issue system wide (global) charger commands. Both OutBack MX and FX products will respond to global charger commands if they are connected through the HUB.

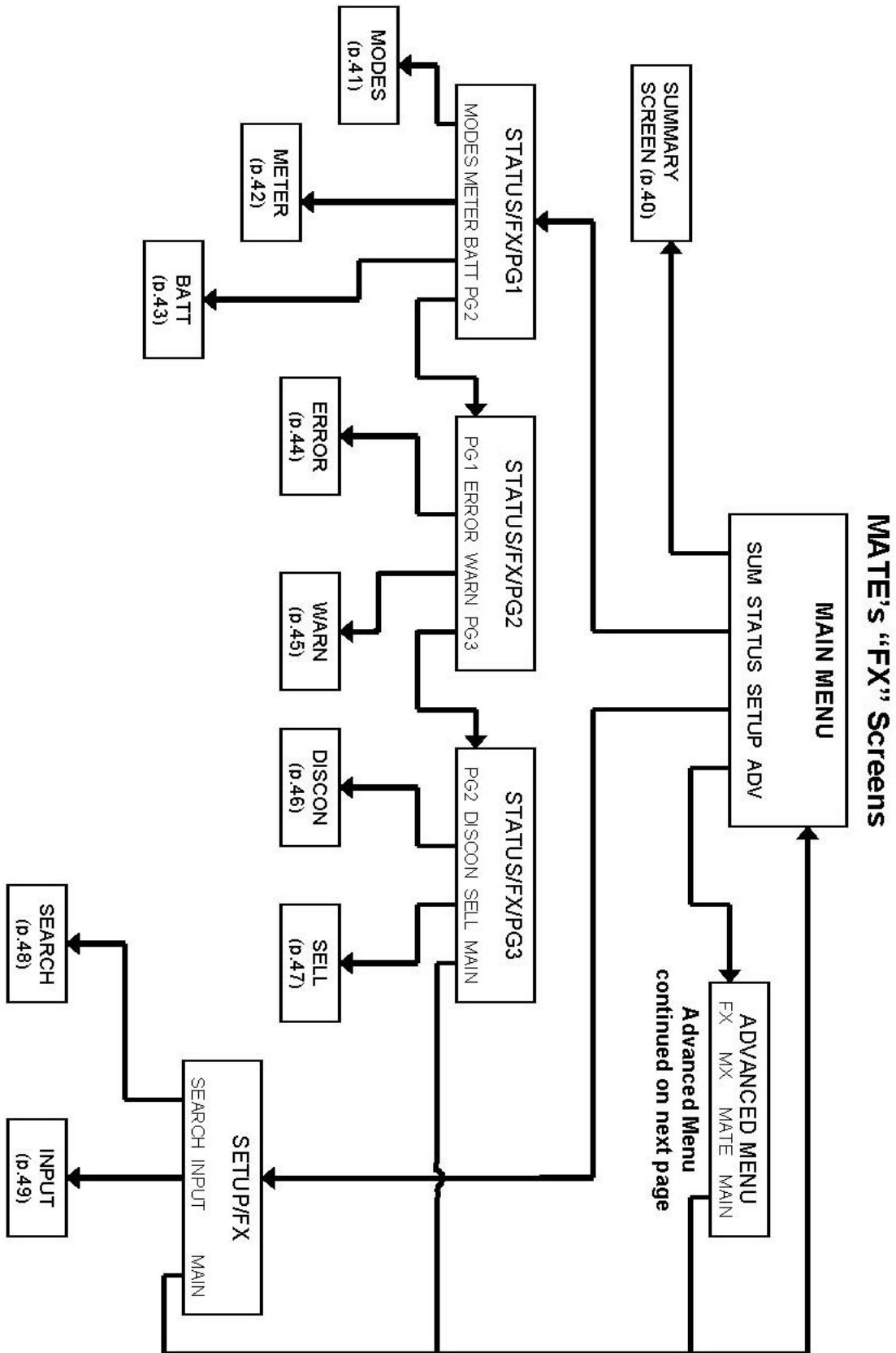
BULK CONTROL		
START	STOP	OK

Pressing **<BULK>** brings up the **BULK CONTROL** screen, it will allow the user to start and/or stop a bulk charge cycle manually by pressing **<START>** or **<STOP>** respectively.

Pressing **<EQ>** brings up the **EQUALIZE CONTROL** screen.

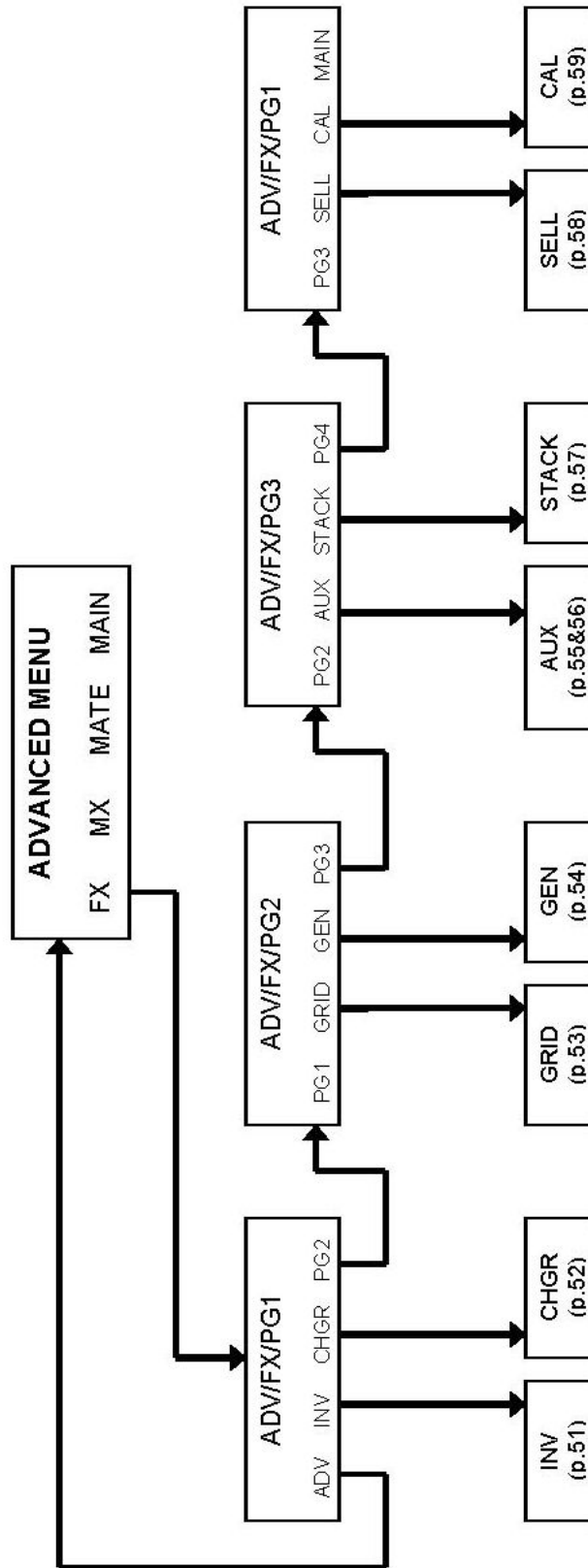
When **<START>** has been selected, two informational screens are displayed. The user then must answer **<YES>** before an equalize charging cycle is allowed to begin.

Once the equalizing process has started, you can stop it at anytime by selecting **<STOP>** from this same control screen.





MATE's "FX Advanced Menu" Screens



## Summary Screen

The OutBack MATE includes a **SUMMARY** screen to allow easy understanding of the FX operation. The display uses both words and symbols to show what currently is happening in the system, along with a limited amount of numbers. This makes it easier for the system user to understand where the power is flowing within the system. The first line of the summary screen displays "DC↔AC" and is measured in kilowatts (kW). This is to indicate the approximate AC power that is being both produced and consumed by all the FX's connected to the MATE (multiple FX's can be connected to one MATE through the HUB). Basically, it shows how much work the FX's are doing and relates to energy being transferred between the FX's and the batteries. The second line of the summary screen displays "AC Load" and has a light bulb symbol that appears for every 500 watts of power per FX that is being delivered to the AC loads (so 1 one light bulb equals 1kW when two inverters are used with a single MATE). The third line displays four different things depending of the status of the AC input. It displays "No ACIN" when the FX doesn't sense an AC source present. It displays "AC Drop" when an AC source is present but not connected. It displays "Buying" when an AC source is connected and the FX is using the source to charge or pass-through to the loads. Finally, it displays "Selling" when the FX is pushing power back into the AC source (Grid-Tie FX's only). In the third line, the symbol used to denote 500 watts or power per inverter is a dollar sign. The fourth line of the summary screen provides information about the battery (limited to battery voltage at this time).

To access the summary screen, press the button under the label SUM from the MAIN screen. Included below are some examples of different summary screens with an explanation of the information represented.

```

MAIN-----
      6:54:42P
SUM STATUS SETUP ADV
↓
DC↔AC . . . . . 0.0kW
AC Load . . . . .
No ACIN . . . . .
Battery          12.8V
    
```

The **MAIN** screen is where the menu system starts. The four words in the bottom line of the display correspond to the four buttons located below the display. The word in **BOLD** on the bottom line indicates the selection used to advance the display to the next screen. Pressing the left two buttons simultaneously from anywhere in the menu will return you to this screen.

To access the summary screen, select SUM from the MAIN screen. A typical summary screen is shown here for a FX when the inverter is off and no AC source is connected.

The battery voltage is provided in the lower right corner of the display.

### EXAMPLES

```

DC↔AC >>> . 1.4kW
AC Load *** . . . .
No ACIN . . . . .
Battery          12.1V
    
```

**INVERTING:** The FX is inverting and producing AC output voltage which is powering 1.4kW of AC loads. No AC source is connected to the inverter.

```

DC↔AC . . . . . 0.0kW
AC Load * . . . . .
Buying $$ . . . . .
Battery          12.6V
    
```

**PASS-THROUGH:** An AC source has been connected and the AC loads are drawing power from the AC source that is passing through the FX. The top line shows 0.0 kW indicating that the charger is in SILENT mode and is not charging the batteries. Approximately 1.0 kW loads are being powered from the AC source (assuming the system consists of one FX).

```

DC↔AC >>> . 1.7kW
AC Load * . . . . .
Buying $$$$ . . . .
Battery          13.4V
    
```

**BUYING (CHARGING & PASS-THROUGH):** The FX is buying (four \$ ≈ 2.0kW) more power than it is delivering to the loads (one \* ≈ 0.5kW). This is an indication that the FX is using the excess power to charge the batteries. The charger is charging at a rate of 1.7 kW of AC power going into the battery. The AC loads are low and are being powered from the AC source.

```

DC↔AC >>>> 2.5kW
AC Load ***** . .
AC Drop . . . . .
Battery          12.3V
    
```

**AC DROP:** The inverter is on and powering 2.5 kW of AC load from the batteries. The AC source is available but DROP was selected in the AC INPUT CONTROL. This will also be displayed when an AC source is available but not in use, such as during the initial time delay period once an AC source has been connected.

```

DC↔AC >>>> 2.2kW
AC Load * . . . . .
Selling $$$ . . . .
Battery          13.4V
    
```

**SELLING:** The FX is selling power back to the utility grid at about 1.5kW. It is also supplying about 0.5kW of AC loads. The FX is taking about 2.2kW of power from the batteries. This excess battery power is coming from a different source (solar, wind, hydro, etc). This screen will only appear on "Grid-Tie" FX's.

# Status Screens

The **STATUS** screens allow the system user to check the operation of the FX system. Both AC and DC voltage and AC current meters are provided to enable monitoring, adjustment and troubleshooting of the system operation.

## MODES MENU

The **MODES** section lets the user view and change the various modes for a specific FX by pressing the PORT button to access a specific FX. The modes include inverter, ac in, charger, auxiliary, and equalize. The operation of these modes can be changed by selecting the **CHANGE MODE** option on the screen. This is helpful if the user wishes to quickly enable or disable a particular function of a specific FX if necessary. If the system is "OutBack" stacked, only the Master's modes, with the exception of the "Aux", can be changed.

```

MAIN-----
      6:54:42P
SUM STATUS SETUP ADV
    
```

The **MAIN** screen is where the menu system starts. The four words in the bottom line of the display correspond to the four buttons located below the display. The word in **BOLD** on the bottom line indicates the selection used to advance the display to the next screen. Pressing the left two buttons simultaneously from anywhere in the menu will return you to this screen.

```

STATUS-----
choose product:
FX  MX
    
```

Selecting **<STATUS>** allows selection of the product type:

```

<FX>      FX inverter/charger system
MX         MX60 PV MPPT charge controller
    
```

```

STATUS/FX/PAGE1----
choose category:
MODES METER BATT PG2
    
```

**<MODES>** Shows status and allows adjustment of Inverter, AC input, Charger, Aux, and EQ  
**METER** Provides the AC voltages and currents of the FX  
**BATT** Provides the battery voltage and charger set points and timers  
**PG2** Displays additional sections – ERRORS, WARNINGS and PG3

```

STATUS/FX/MODE--P00
inv control:      ON
                CHANGE
DOWN STAT  MODE  PORT
    
```

The **INV CONTROL** screen lets you see the status of the inverter function of the FX. Pressing the STAT button returns you to the first page of the status menu. Pressing the CHANGE MODE button opens a screen that gives the options of turning the inverter OFF, turning the inverter ON, or putting the inverter into SEARCH. Pressing PORT will access the next FX if a HUB is present.

```

STATUS/FX/MODE--P00
ac in control:   USE
                CHANGE
DOWN UP  MODE  PORT
    
```

The **AC IN CONTROL** screen lets you see if the FX will accept an AC source at its input terminals. Pressing the UP button returns you to the previous page of the MODES menu. Pressing the CHANGE MODE button opens a screen that gives the options of rejecting an AC source by pressing DROP or accepting an AC source by pressing USE. Pressing PORT will access the next FX if a HUB is present.

```

STATUS/FX/MODE--P00
chr control:     AUTO
                CHANGE
DOWN UP  MODE  PORT
    
```

The **CHR CONTROL** screen lets you see what mode the charger is in. Pressing the UP button returns you to the previous page of the MODES menu. Pressing the CHANGE MODE button opens a screen that gives the options of turning the charger OFF or putting the charger into AUTO where it will follow the 5-stage charging algorithm. Pressing PORT will access the next FX if a HUB is present.

```

STATUS/FX/MODE--P00
aux control:    AUTO
                CHANGE
DOWN UP  MODE  PORT
    
```

The **AUX CONTROL** screen lets you see the status of the auxiliary output. Pressing the UP button returns you to the previous page of the MODES menu. Pressing the CHANGE MODE button opens a screen that gives the options of turning the Aux OFF, turning the Aux ON, or putting the Aux into AUTO mode. In AUTO mode it will follow the "Aux Output Function" and its parameters that can be set in the Advanced (ADV) menu. Pressing PORT will access the next FX if a HUB is present.

```

STATUS/FX/MODE--P00
eq enabled:     No
                CHANGE
                UP  MODE  PORT
    
```

The **EQ ENABLED** screen lets you see if the FX is in an "equalize" charging cycle and can also start or stop a cycle. Pressing the UP button returns you to the previous page of the MODES menu. Pressing the CHANGE MODE button opens a screen that gives the options of START or STOP to initiate or cancel an equalize charge. Pressing PORT will access the next FX if a HUB is present.

## METER MENU

The **METER** section lets the user view the AC voltage and AC current meters as well as the software revision of the FX's microprocessor. The user can view the input and output AC voltages, as well as the input, inverter, charger and sell currents. This can be used to verify that the FX is sensing voltages and currents and also helps discern what the FX is doing (like charging or inverting). The software revision is helpful when troubleshooting. Some functions of certain software revisions are incompatible with older MATEs. The values displayed are not defaults.

```
STATUS/FX/PAGE1-----
choose category:

MODES METER BATT PG2
```



```
Invert          P00
inv 0.0kw  zer 0.0kw
chg 0.0kw  buy 0.0kw
DOWN      STATUS PORT
```



```
STATUS/FX/METER--P00
output          120 vac
voltage
DOWN UP TOP PORT
```



```
STATUS/FX/METER--P00
input          120 vac
voltage
DOWN UP TOP PORT
```



```
STATUS/FX/METER--P00
inverter       0.0 aac
current
DOWN UP TOP PORT
```



```
STATUS/FX/METER--P00
charger        0.0 aac
current
DOWN UP TOP PORT
```



```
STATUS/FX/METER--P00
input          0.0 aac
current
DOWN UP TOP PORT
```



```
STATUS/FX/METER--P00
sell           0.0 aac
current
DOWN UP TOP PORT
```



```
STATUS/FX/METER--P00
FX firmware    75
revision
DOWN UP TOP PORT
```



```
STATUS/FX/METER-----
end of meter menu

UP TOP STATUS
```

**MODES** Shows status and allows adjustment of Inverter, AC input, Charger, Aux, and EQ  
**<METER>** Provides the AC voltages and currents of the FX  
**BATT** Provides the battery voltage and charger set points and timers  
**PG2** Displays additional sections – ERRORS, WARNINGS and PG3

This screen shows the mode and where power is flowing within the FX. The modes include **Invert**, **Charge**, **Pass Through**, **Support**, and **Sell**. When the FX is in the Invert, Support, or Sell mode, the **inv 0.0kw** meter will change. When the FX is in the Charge mode, the **chg 0.0kw** meter will change. Only for Grid-Tie FX's, the **zer 0.0kw** will change to **sel 0.0kw** and change when the FX is in the Sell mode. The **buy 0.0kw** meter will change when the FX is either in Pass Through or Charge mode.

The **OUTPUT VOLTAGE** meter indicates the AC voltage on the AC output of the FX which is available to power the AC loads. When the inverter is in the SEARCH mode, the AC output voltage may not be the nominal output of 120 VAC. This is a normal condition – Increasing the AC load or selecting ON from the INVERTER CONTROL menu screen will return the AC output voltage to normal.

The **INPUT VOLTAGE** meter indicates the AC voltage on the AC input of the FX system from an AC source, such as utility grid or back-up generator. When the FX is connected to an AC source, the input AC voltage will equal the output AC voltage. If the FX is not connected to the AC source the two voltages can differ significantly.

The **INVERTER CURRENT** meter indicates the amount of current being supplied to the AC loads connected to the FX's AC output terminals when the inverter is ON and no AC source is connected. Each "aac" (amp AC) equals approximately 120 watts of load. When the FX system is connected to an AC source, this meter will read 0.

The **CHARGER CURRENT** meter indicates the amount of AC current being used by the battery charger of the FX. Each "aac" (amp AC) equals approximately 120 watts of charge. This meter will read zero when the FX is not connected to an AC source.

The **INPUT CURRENT** meter indicates the total amount of current flowing into the AC input of the FX. Some of this power may be used by the battery charger with the remainder flowing through the AC transfer switch to the AC loads (Passing Thru). To estimate the amount of current being used by the AC loads, subtract the CHARGER CURRENT value from the INPUT CURRENT value.

The **SELL CURRENT** meter indicates the amount of AC current that the FX is pushing back into the utility grid. This screen is only operational on "Grid-Tie" FX models. Multiply this number by the INPUT VOLTAGE to get the power being sold back to the utility grid.

This menu displays the **FX FIRMWARE REVISION** number for the software loaded into the FX's microcomputer. This may be required when troubleshooting or expanding your system. This is not the same as the software version in the MATE.

Selecting TOP returns the user to the top of the STATUS/FX/METER menu section. Selecting STATUS returns to the STATUS screen.

## BATTERY MENU

The **BATTERY** menu section allows the user to check the status of the battery voltage and the battery charging process. Both the actual battery voltage and the temperature compensated battery voltage are provided. The battery charging process set points are displayed along with the associated timer for the charging process. No adjustments are allowed from this section. To change the battery charger's operation, go the **ADVANCED** programming section. The values displayed are not defaults.

```
STATUS/FX/PAGE1-----
choose category:
MODES METER BATT PG2
```

MODES Shows status and allows adjustment of Inverter, AC input, Charger, Aux, and EQ  
 METER Provides the AC voltages and currents of the FX  
**<BATT>** Provides the battery voltage and charger set points and timers  
 PG2 Displays additional sections – ERRORS, WARNINGS and PG3

```
STATUS/FX/BATT---P00
battery 12.2 vdc
actual
DOWN STATUS PORT
```

Selecting **BATT** displays the **BATTERY ACTUAL** voltage measured by the FX. If the RTS battery temperature sensor is connected, then the actual battery voltage will probably not equal the temperature compensated battery voltage. When charging, the FX uses the temperature compensated battery voltage reading (next screen down) to obtain the charging voltages.

```
STATUS/FX/BATT---P00
battery 12.2 vdc
temp compensated
DOWN UP TOP PORT
```

This menu displays the **BATTERY TEMP COMPENSATED** voltage which is used by the battery charger for regulation. The Remote Temperature Sensor (RTS) must be connected to the Master FX for temperature compensation. If the RTS is connected then this value will be higher than the **ACTUAL BATTERY VOLTAGE** when the battery is hot and will be lower than the actual battery voltage when the battery is cold. Refer to this value to verify the state of the charging process.

```
STATUS/FX/BATT---P00
absorb 14.4 vdc
set point
DOWN UP TOP PORT
```

This is the battery charger set point for the absorb stage of the battery charging process. The voltage will be held at the **ABSORB SET POINT** voltage level for the **ABSORB TIME LIMIT** period that is set in the **ADVANCED** menu section. This value can only be changed in the **ADVANCED** menu.

```
STATUS/FX/BATT---P00
absorb 01.0 hrs
time remaining
DOWN UP TOP PORT
```

The **ABSORB TIME REMAINING** is the period of time remaining for the absorb cycle. When the FX is performing an absorb charge this time value will start counting down once the absorb voltage has been reached. When this value reaches 0.0 hrs, the FX will go into **SILENT** (charger turns off) mode until the battery voltage drops to the **REFLOAT** voltage.

```
STATUS/FX/BATT---P00
float 13.6 vdc
set point
DOWN UP TOP PORT
```

This is the battery charger set point for the float stage of the battery charging process. After finishing the absorb charging stage the charger turns off and waits for the battery voltage to drop to the refloat voltage set point before the charger begins to float the battery. The voltage will be held at the **FLOAT SET POINT** voltage level for the float time period that is shown in the next screen down.

```
STATUS/FX/BATT---P00
float 00.0 hrs
time remaining
DOWN UP TOP PORT
```

The **FLOAT TIME REMAINING** is the amount of time remaining for the float stage of the battery charging process. The battery charger does not continuously float the batteries. It instead only floats for the **FLOAT TIME LIMIT** period set in the **ADVANCED** menu section. Once the time period has been met, the charger turns off (called **SILENT** on the **SUMMARY** screen). Only when the FX is in the "Float" charging stage will the "float time remaining" value appear and start to count down.

```
STATUS/FX/BATT---P00
refloat 12.2 vdc
set point
DOWN UP TOP PORT
```

The **REFLOAT SET POINT** is the battery voltage at which the battery charger will restart the float charging process and hold it there for the **FLOAT TIME PERIOD**. This setting is compared with the **BATTERY ACTUAL** voltage, not the **BATTERY TEMP COMPENSATED** voltage.

```
STATUS/FX/BATT---P00
equalize 14.6 vdc
set point
DOWN UP TOP PORT
```

This is the battery charger set point for the equalize stage of the battery charging process. The voltage will be held at the **EQUALIZE SET POINT** voltage level for the equalize time period that is programmed in the **ADVANCED** menu section. The equalization process must be manually triggered while an AC source is connected to the FX's AC input. Equalize can be triggered by pressing the **AC IN** button four times, pressing the **EQ** button then selecting **START**. EQ is not temp compensated.

```
STATUS/FX/BATT---P00
equalize 00.0 hrs
time remaining
DOWN UP TOP PORT
```

The **EQUALIZE TIME REMAINING** is the amount of time remaining for the equalize stage of the battery charging process. Once the **EQUALIZE TIME** period has been met, the charger turns off. When the FX is in the "Equalize" charging stage, the "equalize time remaining" value appears and starts to count down.

```
STATUS/FX/BATT---P00
battery temp 255
(not in degrees C/F)
DOWN UP TOP PORT
```

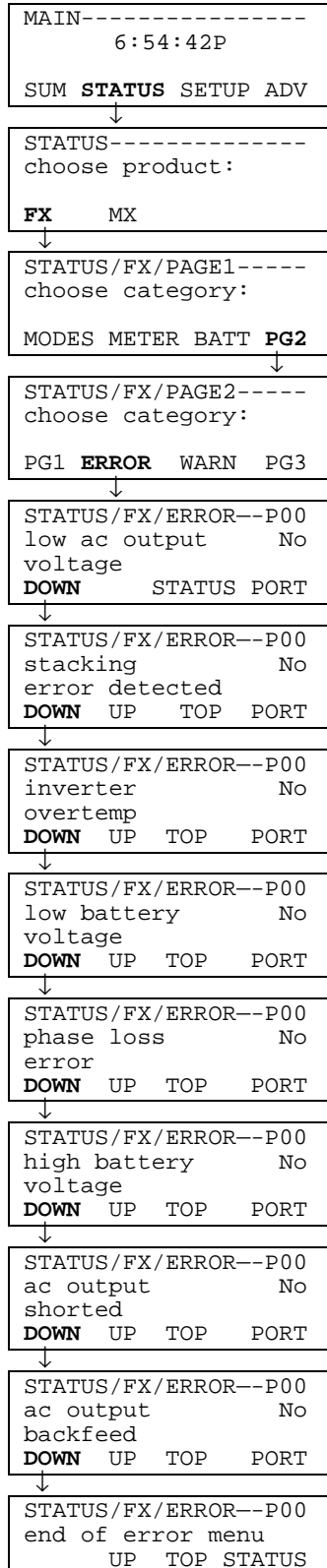
The **BATTERY TEMP** is a reference value used by the battery charger when an RTS is connected to the FX. A displayed value of 255 means the sensor is not connected or has been damaged. At normal room temperatures a value around 130 ± 15 will be shown. As the battery temperature increases, the value displayed will get lower and vice versa.

```
STATUS/FX/BATT-----
end of battery menu
UP TOP STATUS
```

Selecting **TOP** returns the user to the top of the **STATUS/FX/BATT** menu section. Selecting **STATUS** returns to the **STATUS** screen.

## ERROR MENU

The **ERROR** section allows the user to check the cause of an error condition. When an error has occurred, the red error LED indicator in the FX's wiring compartment will be illuminated (not to be confused with a blinking "ERROR" LED that indicates a WARNING). If an error occurs, the FX will cease operation and the MATE will display an error screen. Pressing **<VIEW ERROR>** from this screen brings the user to the 1<sup>st</sup> screen of a list of error causes that will be available by pressing the **DOWN** button. The presence of the word "YES" to the right of the appropriate cause indicates that this error has occurred. It is possible for multiple errors to occur simultaneously. Check every error condition to make sure. An error can be cleared by pressing the **<INV>** button on the MATE and then turning the FX **<OFF>** and then **<ON>**. The inverter automatically resets from over-temperature and low or high battery voltage conditions.



The **MAIN** screen is where the menu system starts. The four words in the bottom line of the display correspond to the four buttons located below the display. The word in **BOLD** on the bottom line indicates the selection used to advance the display to the next screen. Pressing the left two buttons simultaneously from anywhere in the menu will return you to this screen.

Allows selection of the product type:

**<FX>** FX inverter/charger system  
**MX** MX60 PV MPPT charge controller

**MODES** Status and allows adjustment of Inverter, AC input, Charger, Aux, and EQ  
**METER** Provides the AC voltages and currents of the FX  
**BATT** Provides the battery voltage and charger set points and timers  
**<PG2>** Displays additional sections – ERRORS, WARNINGS and PG3

**PG1** Returns to page 1 of the STATUS section  
**<ERROR>** Displays the different causes for errors and qualifies each cause with a Yes or No  
**WARN** Displays the different causes for warnings and qualifies each with a Yes or No  
**PG3** Displays additional sections – reason for last DISCONNECT and SELL

**LOW AC OUTPUT VOLTAGE** indicates that the inverter was not able to maintain adequate AC output voltage (105 VAC or above) to power the loads connected. This is typically caused by the load demanding more power than the inverter is able to deliver.

**STACKING ERROR DETECTED** indicates that a problem has occurred with the communication cabling between stacked FX's, or if the FX's are stacked incorrectly. Check the stacking programming. If this condition persists contact your dealer for servicing instructions.

**INVERTER OVERTEMP** indicates that the FX reached its maximum allowed operating temp. This can be caused by powering large AC loads or charging for too long. It can also be caused by restricting the amount of air which is able to flow around the casting or operation in high temp environments. The FX will automatically reset and resume operation once it cools down.

**LOW BATTERY VOLTAGE** indicates that the battery voltage dropped below the LOW BATTERY CUT-OUT VOLTAGE set point (default of 10.5 volts for a 12 volt FX) for 5 minutes. The inverter will restart once the battery voltage exceeds the LOW BATTERY CUT-IN VOLTAGE set point (default of 12.5 volts for a 12 volt FX) for 10 minutes.

**PHASE LOSS ERROR** is not operational at this time. If a 'Yes' accompanies this Error, please disregard and look for other error causes.

**HIGH BATTERY VOLTAGE** indicates that the battery voltage rose above the high battery voltage level (default of 20 volts for a 12 volt FX) for 10 seconds. The inverter will restart once the battery voltage drops below the high battery voltage (default of 20 volts for a 12 volt FX) for 1 second.

**AC OUTPUT SHORTED** indicates that the inverter immediately reached its maximum current and shut down. This is usually caused by a short circuit condition (hence the AC OUTPUT SHORTED label) but can also be caused by attempting to operate a load which far exceeds the inverter output capability.

**AC OUTPUT BACKFEED** indicates that another AC source of power was connected to the AC output of the FX. Usually this is an installation issue. It often occurs when there is an X-240 transformer in the system that hasn't been installed properly. Also, check that there are no connections between the AC input and AC output circuitry.

Selecting TOP returns the user to the top of the STATUS/FX/ERROR menu section. Selecting STATUS returns to the first page of the STATUS screen.

**WARNING MENU**

The **WARNINGS** section of the STATUS menu allows the user to check the cause of a warning condition for the FX. When a warning condition has occurred, the red "ERROR" LED indicator in the FX's wiring compartment will flash. The cause of the warning will not be displayed on the MATE like an ERROR will. Instead, you must access this WARNINGS menu and scroll down the list to find out which warning is present. This is indicated by the presence of a "YES" next to the appropriate cause listed. Once the cause for the warning is no longer present, the display will change back to "NO" as shown below and the red LED will stop flashing. A warning will not shut the FX down like an error will.

```
STATUS/FX/PAGE2-----
choose category:
PG1 ERROR  WARN  PG3
```

PG1 Returns to page 1 of the STATUS section  
 ERROR Displays the different causes for errors and qualifies each cause with a Yes or No  
 <WARN> Displays the different causes for warnings and qualifies each with a Yes or No  
 PG3 Displays additional sections – reason for last DISCONNECT and SELL

```
STATUS/FX/WARN---P00
acin freq No
too high
DOWN STATUS PORT
```

**AC IN FREQUENCY TOO HIGH** indicates that the AC input connected to the FX is above the upper limit of its frequency window and will not connect to the AC source if the frequency stays this high. If the frequency of the AC source is above 66 Hz, the FX will display this warning.

```
STATUS/FX/WARN---P00
acin freq No
too low
DOWN UP TOP PORT
```

**AC IN FREQUENCY TOO LOW** indicates that the AC input connected to the FX is below the lower limit of its frequency window and will not connect to the AC source if the frequency stays this low. If the frequency of the AC source is below 54 Hz, the FX will display this warning.

```
STATUS/FX/WARN---P00
acin voltage No
too high
DOWN UP TOP PORT
```

**AC IN VOLTAGE TOO HIGH** indicates that the AC source's voltage is over the upper limit (default is 140 VAC) of the FX's voltage window. The FX will not connect to the AC source until the voltage drops below the upper limit.

```
STATUS/FX/WARN---P00
acin voltage No
too low
DOWN UP TOP PORT
```

**AC IN VOLTAGE TOO LOW** indicates that the AC source's voltage is below the lower limit (default is 108 VAC) of the FX's voltage window. The FX will not connect to the AC source until the voltage rises above the lower limit.

```
STATUS/FX/WARN---P00
ac input No
current exceeds max
DOWN UP TOP PORT
```

**AC INPUT CURRENT EXCEEDS MAX** indicates that the AC loads are drawing more current than the AC INPUT LIMIT of the FX is programmed for. Exceeding this current limit for an extended period of time could cause the FX to fail, a generator to disconnect or a breaker to trip. Reduce the loads on the FX's AC output to prevent damage and, for Mobile versions of the FX, make sure a 30A breaker (maximum) is used on the AC input line.

```
STATUS/FX/WARN---P00
temperature No
sensor fault
DOWN UP TOP PORT
```

**TEMPERATURE SENSOR FAULT** indicates that one of the temperature sensors internally located in the FX is not working correctly. The FX needs to be checked by a qualified repair technician. The AIRTEMP, FETTEMP and CAPTEMP screens shown below can help with troubleshooting.

```
STATUS/FX/WARN---P00
internal comm No
error detected
DOWN UP TOP PORT
```

**INTERNAL COMMUNICATION ERROR DETECTED** indicates that a communication problem has occurred between the MATE and the FX. This warning may occur if the communication lines between the FX and the MATE have been severed or disconnected. If this is the case, connect a working cable and perform a "Re-Poll" of the system using the MATE. See the MATE manual for instructions. If this does not solve the problem, call your dealer for assistance.

```
STATUS/FX/WARN---P00
internal fan No
failure detected
DOWN UP TOP PORT
```

**INTERNAL FAN FAILURE DETECTED** warns that the fan mounted above the transformer inside the FX has stopped working or is not functioning properly. This will eventually cause an INVERTER OVERTEMP error if the cause of the fan failure is not fixed. Restart the FX and listen for the fan to verify a fan failure. The fan should run for about 15 seconds on start-up.

```
STATUS/FX/WARN---P00
airtemp 206
DOWN UP PORT
```

**AIRTEMP** shows a numerical value that the FX understands as a temperature. The value comes from a sensor inside the FX that measures the temperature of the air (or transformer, depending upon the FX's serial number). This warning is given for troubleshooting purposes.

```
STATUS/FX/WARN---P00
fettemp 200
DOWN UP PORT
```

**FETTEMP** shows a numerical value that the FX understands as a temperature. The value comes from a sensor inside the FX that measures the temperature of the FETs (Field Effect Transistors). This warning is given for troubleshooting purposes.

```
STATUS/FX/WARN---P00
captemp 203
DOWN UP PORT
```

**CAPTEMP** shows a numerical value that the FX understands as a temperature. The value comes from a sensor inside the FX that measures the temperature of the ripple capacitors. This warning is given for troubleshooting purposes.

```
STATUS/FX/WARN-----
end of warnings menu
UP TOP STATUS
```

Selecting TOP returns the user to the top of the STATUS/FX/WARN menu section. Selecting STATUS returns to the STATUS screen to allow selection of another product.

## DISCONNECT MENU

The FX includes a section that displays the reason for last **DISCONNECT** from the AC source. This is helpful if the FX rejects the AC source and the user wants an explanation and help on rectifying the problem. The FX will disconnect from an AC source if the AC source falls out of the FX's frequency or voltage ranges. If the AC source disconnects from the FX and none of the reasons for disconnect are followed by a "Yes" it is possible that the AC source shut itself down (this is sometimes the case with smaller generators, or generators with an internal temperature "shutdown" switch).

```

MAIN-----
      6:54:42P
SUM STATUS SETUP ADV
    
```

The **MAIN** screen is where the menu system starts. The four words in the bottom line of the display correspond to the four buttons located below the display. The word in **BOLD** on the bottom line indicates the selection used to advance the display to the next screen. Pressing the left two buttons simultaneously from anywhere in the menu will return you to this screen.

```

STATUS-----
choose product:
FX  MX
    
```

Allows selection of the product type:

**<FX>** FX inverter/charger system  
 MX MX60 PV MPPT charge controller

```

STATUS/FX/PAGE1-----
choose category:
MODES METER BATT PG2
    
```

**MODES** Status and allows adjustment of Inverter, AC input, Charger, Aux, and EQ  
**METER** Provides the AC voltages and currents of the FX  
**BATT** Provides the battery voltage and charger set points and timers  
**<PG2>** Displays additional sections – ERRORS, WARNINGS and PG3

```

STATUS/FX/PAGE2-----
choose category:
PG1 ERROR WARN PG3
    
```

**PG1** Returns to page 1 of the STATUS section  
**ERROR** Displays the different causes for errors and qualifies each cause with a Yes or No  
**WARN** Displays the different causes for warnings and qualifies each with a Yes or No  
**<PG3>** Displays additional sections – reason for last DISCONNECT and SELL

```

STATUS/FX/PAGE3-----
choose category:
PG2 DISCON SELL MAIN
    
```

**PG2** Displays additional sections – ERRORS, WARNINGS and PG3  
**<DISCON>** Displays the reason that the FX last disconnected from the AC source  
**SELL** Displays the code related to the reason for the last disconnection while selling  
**MAIN** Returns the user to the MAIN menu

```

STATUS/FX/DISCON-P00
acin freq      No
too high
DOWN STATUS PORT
    
```

The **ACIN FREQ TOO HIGH** screen displays a "Yes" if the FX disconnected from the AC source due to the frequency of the AC source exceeding 69 Hz. The MATE does not display the frequency of the AC source, but this can be verified using an oscilloscope. If this message occurs and the AC source is a generator, it may be possible to adjust the frequency of the generator.

```

STATUS/FX/DISCON-P00
acin freq      No
too low
DOWN UP TOP PORT
    
```

The **ACIN FREQ TOO LOW** screen displays a "Yes" if the FX disconnected from the AC source due to the frequency of the AC source being below 51 Hz. The MATE does not display the frequency of the AC source, but this can be verified using an oscilloscope. If this message occurs and the AC source is a generator, it may be possible to adjust the frequency of the generator.

```

STATUS/FX/DISCON-P00
acin voltage   No
> max
DOWN UP TOP PORT
    
```

The **ACIN VOLTAGE > MAX** screen indicates that the AC source's voltage exceeded the maximum AC voltage the FX allows (140 vac default). This value can be adjusted in the ADVANCED menu, in the GRID or GEN sections (depending on your input type). The FX disconnects to protect the loads from high voltage. If you expect significant voltage drop due to long cable runs, it may be safe to raise the limit. This screen is not operational at this time.

```

STATUS/FX/DISCON-P00
acin voltage   No
< min
DOWN UP TOP PORT
    
```

The **ACIN VOLTAGE < MIN** screen indicates that the AC source's voltage is below the minimum AC voltage the FX allows (108 vac default). This value can be adjusted in the ADVANCED menu, in the GRID or GEN sections (depending on your input type). The FX disconnects to protect the loads from low voltage. If your AC source operates near this voltage limit, it could affect the charging function (the FX backs off the charger if the AC voltage reaches the lower limit) and adjusting the limit lower may be in order. This screen is not operational at this time.

```

STATUS/FX/DISCON-----
end of DISCON menu
      UP TOP STATUS
    
```

Selecting TOP returns the user to the top of the STATUS/FX/DISCON menu section. Selecting STATUS returns to the STATUS screen to allow selection of another product.



**SELL MENU**

The **SELL** section of the STATUS menu has only one screen. This screen gives a number that refers to a reason the FX would stop selling. OutBack Power Systems technicians use this number to quickly understand what the FX thinks is happening. The system user should not be concerned about this number unless they are experiencing many unknown grid disconnects and they need troubleshooting help. This screen is only operational with "Grid-Tie" FX's.

```

MAIN-----
      6:54:42P
SUM STATUS SETUP ADV
    
```

The **MAIN** screen is where the menu system starts. The four words in the bottom line of the display correspond to the four buttons located below the display. The word in **BOLD** on the bottom line indicates the selection used to advance the display to the next screen. Pressing the left two buttons simultaneously from anywhere in the menu will return you to this screen.

```

STATUS-----
choose product:
FX  MX
    
```

Allows selection of the product type:  
**<FX>** FX inverter/charger system  
 MX MX60 PV MPPT charge controller

```

STATUS/FX/PAGE1-----
choose category:
MODES METER BATT PG2
    
```

**MODES** Status and allows adjustment of Inverter, AC input, Charger, Aux, and EQ  
**METER** Provides the AC voltages and currents of the FX  
**BATT** Provides the battery voltage and charger set points and timers  
**<PG2>** Displays additional sections – ERRORS, WARNINGS and PG3

```

STATUS/FX/PAGE2-----
choose category:
PG1 ERROR WARN PG3
    
```

**PG1** Returns to page 1 of the STATUS section  
**ERROR** Displays the different causes for errors and qualifies each cause with a Yes or No  
**WARN** Displays the different causes for warnings and qualifies each with a Yes or No  
**<PG3>** Displays additional sections – reason for last DISCONNECT and SELL

```

STATUS/FX/PAGE3-----
choose category:
PG2 DISCON SELL MAIN
    
```

**PG2** Displays additional sections – ERRORS, WARNINGS and PG3  
**DISCON** Displays the reason that the FX last disconnected from the AC source  
**<SELL>** Displays the code related to the reason for the last disconnection while selling  
**MAIN** Returns the user to the MAIN menu

```

STATUS/FX/SELL---P00
stop sell      14
reason
STATUS        PORT
    
```

The **STOP SELL REASON** displays a numerical value that indicates a reason that the FX stopped selling to the utility grid. It could indicate that the utility grid's voltage or frequency is out of the acceptable ranges or that the utility grid failed altogether. This screen is used for troubleshooting by OutBack Power Systems technicians. Selecting STATUS returns the user to the beginning of the STATUS menu. Selecting PORT selects the next FX on the HUB.

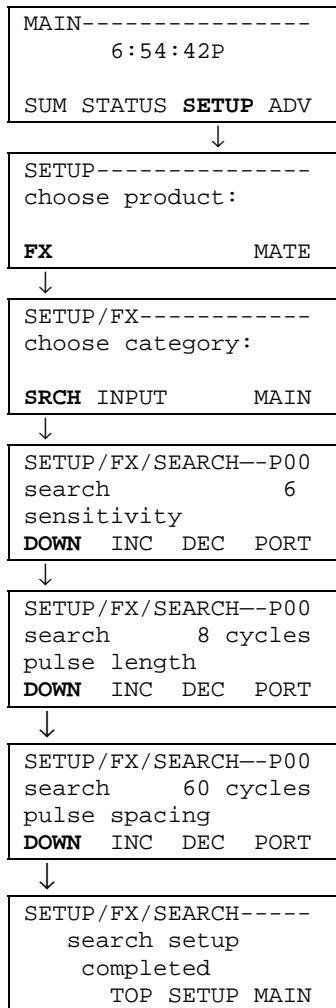
# Setup Screens

The OutBack FX includes a **SETUP** menu to allow limited adjustment of some of the settings which may need to be accessed by the system user.

## SEARCH MENU

The **SEARCH** mode is an automatic system which reduces the power consumption of the FX during periods of no power demand. It is primarily used for off-grid applications where the power is being generated by solar panels or other renewable energy sources and the system user is concerned about conserving every possible watt of power. Properly setup and operated, SEARCH mode can save considerable amounts of power compared to keeping an inverter in the ON mode 24 hours a day.

The FX includes a load detection method that is called “search mode” in which the inverter produces a pulsed AC output to detect the magnitude of the AC load which is connected to the inverter AC output. Once a large enough load has been turned on, the inverter resumes normal operation providing continuous AC power. If the AC load is reduced to a level below the SEARCH SENSITIVITY setting, then the inverter turns off and the pulsed AC output (search mode) is resumed. The power saved by using the SEARCH pulsing method comes both from the reduced consumption of the inverter itself and from the elimination of the power consumed by “phantom” AC loads – appliances which consume power even though they are not operating. The SEARCH SENSITIVITY setting can be adjusted to ignore small AC loads such as a VCR display, etc. Use of the search mode requires some tuning of the settings for the particular loads connected and may not work well with some loads such as fluorescent lights with magnetic ballasts.



The **MAIN** screen is where the menu system starts. The four words in the bottom line of the display correspond to the four buttons located below the display. The word in **BOLD** on the bottom line indicates the selection used to advance the display to the next screen. Pressing the left two buttons simultaneously from anywhere in the menu will return you to this screen.

Allows selection of the product type:

- <FX> FX inverter/charger system
- MATE MATE system display and user interface

The categories are then displayed for the settings which can be adjusted in the setup menu.

- <SRCH> Allows adjustment of the settings for the Search mode.
- INPUT Allows selection of the AC INPUT and current limit adjustment.
- MAIN Returns the display to the MAIN screen.

The **SEARCH SENSITIVITY** setting determines how much AC load (watts) is required to make the FX switch from the ‘search’ mode to the normal inverter ‘on’ mode. Increasing the number (INC) decreases the sensitivity (more watts must be turned ‘on’ to bring the FX out of ‘search’) while decreasing the number (DEC) increases the sensitivity (less watts must be turned ‘on’ to bring the FX out of ‘search’). Adjusting this setting to zero will effectively disable the search mode operation.

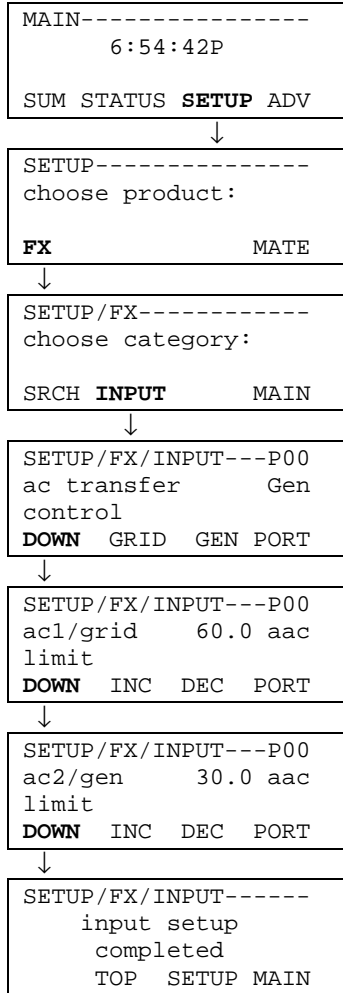
The **SEARCH PULSE LENGTH** setting determines the number of pulses produced by the inverter in quick succession (actually AC cycles) which are used to the AC load that is connected. Some AC loads do not draw much power from a single AC pulse – setting this value to 8 or more pulses may allow the AC load to be detected more reliably. This setting has a range between 4 cycles and 20 cycles in 1 cycle increments.

The **SEARCH PULSE SPACING** is the amount of time (in number of AC cycles) that the inverter waits before producing additional AC pulses to sense a load. The larger this ‘search pulse spacing’ number is, the lower the power consumption of the FX, but the more noticeable the delay between when the AC load is turned ‘on’ and when it actually comes ‘on’. This setting has a range between 4 cycles and 120 cycles (2 seconds) in 1 cycle increments.

Selecting TOP returns the user to the top of the SETUP/FX/SEARCH menu section. Selecting SETUP returns you to the setup screen to allow selection of another product connected to the MATE. Selecting MAIN returns the display to the MAIN screen.

INPUT MENU

The other settings currently accessible to the system user in the SETUP menu involve the AC **INPUT**. The system user can specify what type of AC INPUT is being used, whether it is a generator (GEN) or the utility grid (GRID). Following this are two screens, one for GEN and one for GRID, that allow the user to adjust the maximum AC current that the FX will allow to enter before the FX backs off the charger. If the charger has backed off all the way and the loads require more current than the AC1/Grid or AC2/Gen limits are set to, the FX will produce a warning.



The **MAIN** screen is where the menu system starts. The four words in the bottom line of the display correspond to the four buttons located below the display. The word in **BOLD** on the bottom line indicates the selection used to advance the display to the next screen. Pressing the left two buttons simultaneously from anywhere in the menu will return you to this screen.

Allows selection of the product type:  
**<FX>**           FX inverter/charger system  
MATE             MATE system display and user interface

The categories are then displayed for the settings which can be adjusted in the setup menu.  
SRCH             Allows adjustment of the settings for the Search mode.  
**<INPUT>**       Allows selection of the AC INPUT and current limit adjustment.  
MAIN             Returns the display to the MAIN screen.

The **AC TRANSFER CONTROL** screen lets the user select the type of AC input which is connected to the FX. This is used to choose the source of the AC input entering the FX. The two choices are GRID for the utility grid or GEN for a generator. The settings for the AC source are found in the advanced menu under the headings GRID and GEN (see next page).

The **AC1/GRID LIMIT** is the maximum amount of current that the FX will allow to be drawn by AC loads and battery charger together from the utility grid. When this limit is reached the charger will be “backed off” to keep from overloading the utility grid. This setting has a range between 5.0 aac and 60.0 aac in 1.0 aac increments.

The **AC2/GEN LIMIT** is the maximum amount of current that the FX will allow to be drawn by AC loads and battery charger together from the generator. When this limit is reached the charger will be “backed off” to keep from overloading the generator. This setting has a range between 5.0 aac and 60.0 aac in 1.0 aac increments.

Selecting TOP returns the user to the top of the SETUP/FX/INPUT menu section. Selecting SETUP returns you to the setup screen to allow selection of another product connected to the MATE. Selecting MAIN returns the display to the MAIN screen.

# Advanced Screens

The **ADVANCED** menu section allows adjustment of all the settings involved with the operation of the FX. Changes made to these settings are stored internally in non-volatile memory inside of the FX – the settings are not lost when the MATE is removed or battery power is disconnected.

Some settings appear both in the SETUP and in the ADV menus. Changes made to these settings in one area will cause the same changes to occur in the other area. The settings are provided in both menus to make it more convenient for the FX programmer by giving access to all of the settings in the advanced menu.

Access to the settings in the advanced menu is restricted through the use of a password. This password is required to view and adjust the settings. Once the password has been entered, all ADVANCED categories can be adjusted without having to re-enter the password. If the advanced menu is exited and re-entered, the password must be re-entered, however. Use of the “Hot” keys AC IN and INV is allowed from the advanced menu and selecting OK from these screens will return you to the same point in the advanced menu.

The password for the FX is currently fixed to the same value for all of the FX’s.

## PASSWORD CODE: 1 4 1

```

MAIN-----
      6:54:42P
SUM STATUS SETUP ADV
    
```

The **MAIN** screen is where the menu system starts. The four words in the bottom line of the display correspond to the four buttons located below the display. The word in **BOLD** on the bottom line indicates the selection used to advance the display to the next screen. Pressing the left two buttons simultaneously from anywhere in the menu will return you to this screen.

```

ADV/SETTINGS/WARNING
changes made could
adversely effect
system performance
    
```

Selecting **<ADV>** brings up a warning message. Please read the message. Pressing any of the four keys below the display advances the display to the password screen.

```

ADV/PASSWORD-----
enter the password:
      132
ENTER INC DEC EXIT
    
```

**Entering the correct password** number is done by pressing the **<INC>** key to increase the number or the **<DEC>** key to decrease the number. Once the number shown matches the password code (**141**), press the key below the word **<ENTER>**. To leave the advanced menu area without making any changes, press EXIT.

```

ADV-----
choose product:
FX  MX  MATE  MAIN
    
```

Following the password screen is a screen that allows selection of the OutBack product type. Selecting **<FX>** allows adjustment of the FX’s advanced programming. Selecting MX will allow access to the advanced sections of any MX-60’s connected to the system (through a HUB). Selecting MATE will allow access to the MATE’s advanced screens. Selecting MAIN returns the user to the MAIN menu.

```

ADV/FX/PAGE1-----
choose category:
ADV  INV  CHGR  PG2
    
```

There are eight categories of settings in the FX:

- INV** Allows adjustment of the INVERTER settings and operation
- CHGR** Allows adjustment of the CHARGER settings and operation
- GRID** Allows adjustment of the AC input settings and operation if the FX’s input is set to GRID in the SETUP/FX/INPUT “ac transfer control” screen (see previous page)
- GEN** Allows adjustment of the AC input settings and operation if the FX’s input is set to GEN in the SETUP/FX/INPUT “ac transfer control” screen (see previous page)
- AUX** Allows adjustment of the AUXILIARY output settings and operation
- STACK** Allows adjustment of the master/slave settings for multi-FX systems
- SELL** Allows adjustment of the Grid-Tie settings and operation
- CAL** Allows adjustment of the voltage calibration measurements to improve operation

```

ADV/FX/PAGE2-----
choose category:
PG1  GRID  GEN  PG3
    
```

```

ADV/FX/PAGE3-----
choose category:
PG2  AUX  STACK  PG4
    
```

Selecting ADV will send the user back one screen to the “choose product” screen in the advanced menu. PG2 will advance the user to page 2 of the advanced menu. PG3 will advance the user to page 3 of the advanced menu. PG4 will advance the user to page 4 of the advanced menu. Selecting MAIN will return the user to the MAIN screen.

```

ADV/FX/PAGE3-----
choose category:
PG3  SELL  CAL  MAIN
    
```

## INVERTER MENU

The **INVERTER** category of the advanced menu section allows adjustment of the inverter's operation to match the AC load and battery requirements. Specifically, this section allows adjustment of the search function, the low battery cut-out function, the FX's AC output voltage, and allows the user to reset the FX to its factory defaults.

```

ADV-----
choose product :
FX    MX  MATE  MAIN
    
```

Once the password has been correctly entered, the ADV - CHOOSE PRODUCT menu is displayed. Selecting **<FX>** allows adjustment of the FX's advanced programming.

```

ADV/FX/PAGE1-----
choose category :
ADV  INV  CHGR  PG2
    
```

Selecting **<INV>** allows adjustment of the FX's inverter set points and operation.

```

ADV/FX/INVERTER--P00
search          6
sensitivity
DOWN  INC  DEC
    
```

The **SEARCH SENSITIVITY** setting determines how much AC load is required to make the FX switch from the 'search' mode to the normal inverter 'on' mode. Increasing the number (INC) decreases the sensitivity (more power must be turned 'on' to bring the FX out of 'search') while decreasing the number (DEC) increases the sensitivity (less power must be turned 'on' to bring the FX out of 'search'). Adjusting this setting to zero will effectively disable the search mode operation.

```

ADV/FX/INVERTER--P00
search          8 cycles
pulse length
DOWN  INC  DEC
    
```

The **SEARCH PULSE LENGTH** setting determines the number of pulses produced by the inverter in quick succession (actually AC cycles) which are used to detect level of AC load connected. Some AC loads do not draw much power from a single AC pulse – setting this value to 8 or more pulses may allow the AC load to be detected more reliably. This setting has a range between 4 cycles and 20 cycles in 1 cycle increments.

```

ADV/FX/INVERTER--P00
search          60 cycles
pulse spacing
DOWN  INC  DEC
    
```

The **SEARCH PULSE SPACING** is the number of AC cycles that the inverter waits before producing additional AC pulses. The larger this 'search pulse spacing' number is, the lower the power consumption, but the more noticeable the delay becomes when an AC load is first turned on. This setting has a range between 4 cycles and 120 cycles (2 seconds) in 1 cycle increments.

```

ADV/FX/INVERTER--P00
low battery 10.5 vdc
cut-out set point
DOWN  INC  DEC
    
```

The **LOW BATTERY CUT-OUT** setting determines when the inverter will turn off to prevent over discharge of the battery system. If an AC source is available and the AC INPUT was set to DROP, the FX will change this setting to USE and connect to the AC source to save the batteries. A fixed delay of 5 minutes is included to reduce nuisance inverter shutdowns. This setting has a range between 9.0 vdc and 12.0 vdc in 0.1 vdc increments.

```

ADV/FX/INVERTER--P00
low battery 12.5 vdc
cut-in set point
DOWN  INC  DEC
    
```

The **LOW BATTERY CUT-IN** setting determines when the inverter will turn back on after it had shut off due to a low battery situation. A fixed delay of 10 minutes is provided to reduce the possibility of the system cycling on and off. This setting has a range between 10.0 vdc and 14.0 vdc in 0.1 vdc increments.

```

ADV/FX/INVERTER--P00
adjust          120 vac
output voltage
DOWN  INC  DEC
    
```

The **ADJUST OUTPUT VOLTAGE** setting allows the user to change the output voltage to a lower or higher voltage. This may be necessary if some loads are far away from the FX or if some loads are sensitive to higher voltages. This setting has a range between 110 vac and 125 vac in 1 vac increments.

```

ADV/FX/INVERTER-----
reset FX to factory
defaults
DOWN                                MORE
    
```

The **RESET FX TO FACTORY DEFAULTS** resets all of the settings in the FX back to the factory default set points. **THIS WILL CAUSE ALL OF THE PREVIOUS PROGRAMMING TO BE LOST.** Selecting MORE displays a screen that allows the user to select which port on the HUB that the FX to be reset is on. Once the user has chosen the PORT of if there is not a HUB the user should press NEXT to proceed. To complete the reset to factory defaults, the user must press 1 and then 2.

```

ADV/FX/INVERTER-----
inverter programming
completed
TOP  ADV  MAIN
    
```

Selecting TOP returns the user to the top of the ADV/FX/INVERTER menu section. Selecting ADV returns you to the advanced screen to allow selection of another product connected to the MATE. Selecting MAIN returns the display to the MAIN screen.

## CHARGER MENU

The **CHARGER** section allows for adjustment of the battery charger's operation to match the requirements of the batteries used. OutBack's default battery charging set points may not be correct for the type of batteries being used. Please contact the battery manufacturer for correct ABSORB, FLOAT and EQUALIZE voltages. See the BATTERY CHARGING INSTRUCTIONS section for guidelines on how to set some of these values and for more information on the battery charging process.

```

ADV-----
choose product:
FX                MATE
    
```

Once the password has been correctly entered, the ADV - CHOOSE PRODUCT is displayed. Selecting <FX> allows adjustment of the FX's advanced programming.

```

ADV/FX/PAGE1-----
choose category:
ADV  INV  CHGR  PG2
    
```

Selecting <CHGR> allows adjustment of the battery charger set points and operation.

```

ADV/FX/CHARGER---P00
charger          18.0 aac
limit
DOWN  INC  DEC  PORT
    
```

The **CHARGER LIMIT** is the maximum amount of AC current that will be used by the FX to charge the batteries. In most systems this setting will not need to be changed. This setting has a range as low as 0.0 aac and as high as 12.0 aac to 20.0 aac (depending on the model) in 1.0 aac increments.

```

ADV/FX/CHARGER---P00
absorb          14.4 vdc
setpoint
DOWN  INC  DEC  PORT
    
```

The **ABSORB SET POINT** is the voltage that the batteries will be charged to during the first stage of the charging process. The BULK stage of charging raises the battery voltage to the ABSORB voltage and allows the batteries to regain their charge. The 'Absorb Time Limit' must be long enough for the batteries to regain 85% - 95% of their charge. This setting has a range between 13.0 vdc and 16.0 vdc in 0.1 vdc increments.

```

ADV/FX/CHARGER---P00
absorb          01.0 hrs
time limit
DOWN  INC  DEC  PORT
    
```

The **ABSORB TIME LIMIT** can be adjusted to provide enough time at the 'Absorb Setpoint' to achieve a fully recharged battery. For large battery banks a longer time may be required – small battery banks may require a lower setting. This setting has a range between 0 hours and 24 hours in 0.1 hour increments.

```

ADV/FX/CHARGER---P00
float           13.6 vdc
setpoint
DOWN  INC  DEC  PORT
    
```

The **FLOAT SET POINT** is the voltage that the batteries will be 'trickle' charged to (manually started generator only). This charge will finish the charging process by putting the last few percentage points of charge into the batteries. This set point can be adjusted to match the specific requirements of the batteries being charged. This setting has a range between 12.0 vdc and 15.0 vdc in 0.1 vdc increments.

```

ADV/FX/CHARGER---P00
float           01.0 hrs
time period
DOWN  INC  DEC  PORT
    
```

The **FLOAT TIME PERIOD** can be adjusted to set the amount of time that the battery bank is held at the 'Float Setpoint'. For large battery banks a longer time may be required – smaller battery banks may require a lower setting. Once the battery has been held at the 'Float Setpoint' for the 'Float Time Period', the battery charger goes silent and provides no charge to the battery. This setting has a range between 0 hours and 24 hours in 0.1 hour increments.

```

ADV/FX/CHARGER---P00
refloat         12.2 vdc
setpoint
DOWN  INC  DEC  PORT
    
```

The **REFLOAT SET POINT** voltage is used to "trigger" the battery charger back into another FLOAT cycle when the battery voltage falls to this set point. This can provide maintenance charging of batteries and is also useful when intermittent DC loads are operated from a battery system and an AC source is available. This setting has a range between 12.0 vdc and 13.0 vdc in 0.1 vdc increments.

```

ADV/FX/CHARGER---P00
equalize        14.6 vdc
setpoint
DOWN  INC  DEC  PORT
    
```

The **EQUALIZE SET POINT** voltage can be set for a high voltage to de-stratify the batteries on occasion. An equalization charge can be started through the AC IN "Hot" key. An AC source must be connected in order to start an equalization charge. The batteries must be supervised throughout the equalization process. Consult the battery supplier as to specific instruction on the battery equalizing process. This setting has a range between 14.0 vdc and 17.0 vdc in 0.1 vdc increments.

```

ADV/FX/CHARGER---P00
equalize        01.0 hrs
time period
DOWN  INC  DEC  PORT
    
```

The **EQUALIZE TIME PERIOD** can be adjusted to limit the amount of time that the battery is equalized. The timer starts to advance once the battery voltage exceeds the absorb voltage set point. Once the timer completes the equalize time period, the charger goes into the silent stage of the charging process. This setting has a range between 0 hours and 24 hours in 0.1 hour increments.

```

ADV/FX/CHARGER-----
charger programming
completed
TOP  ADV  MAIN
    
```

Selecting TOP returns the user to the top of the ADV/FX/CHARGER menu section. Selecting ADV returns you to the advanced screen to allow selection of another product connected to the MATE. Selecting MAIN returns the display to the MAIN screen.

**GRID MENU**

The **GRID** category of the advanced menu section allows for adjustment of the AC input voltage window and time delays to match the characteristics of the AC source if that AC source is the utility grid. This setting can be found in the SETUP/FX/INPUT menu. Only "Grid-Tie" FX's have a default of GRID as the AC source. All other FX types have an AC input default of GEN. If the users AC source is the utility grid, return to the SETUP/FX/INPUT section (page 49) and change the 'AC Transfer Control' screen to GRID.

```
ADV-----
choose product:
FX                MATE
```

Once the password has been correctly entered, the ADV - CHOOSE PRODUCT is displayed. Selecting <FX> allows adjustment of the FX's advanced programming.

```
ADV/FX/PAGE1-----
choose category:
ADV  INV  CHGR  PG2
```

Selecting <PG2> advances the user to the second page of the advanced menu.

```
ADV/FX/PAGE2-----
choose category:
PG1  GRID  GEN  PG3
```

Selecting <GRID> allows adjustment of the AC input set points and operation.

```
ADV/FX/GRID-----P00
ac input    00.5 min
connect delay
DOWN  INC  DEC  PORT
```

The **AC INPUT CONNECT DELAY** set point adjusts the time period of when the FX sees an acceptable AC source to when it connects the AC loads to that source. This is useful to allow the utility grid to become stable after a utility power outage. This setting has a range between 0.2 minutes to 15 minutes in 0.1 minute increments.

```
ADV/FX/GRID-----P00
ac1/grid    108 vac
lower limit
DOWN  INC  DEC  PORT
```

The **AC1/GRID LOWER LIMIT** set point allows adjustment of the minimum voltage that the AC source is allowed to be in order for the FX to connect to that source. The FX will back off the charger if the AC source is at this lower limit. If the AC source falls below this limit, the FX will disconnect from the AC source until it is above this value. This setting has a range between 70 vac and 110 vac in 1 vac increments.

```
ADV/FX/GRID-----P00
ac1/grid    140 vac
upper limit
DOWN  INC  DEC  PORT
```

The **AC1/GRID UPPER LIMIT** set point allows adjustment of the maximum voltage that the AC source is allowed to be in order for the FX to connect to that source. If the AC source exceeds this value, the FX will disconnect from the AC source until it is below this value. This setting has a range between 130 vac and 150 vac in 1 vac increments.

```
ADV/FX/GRID-----P00
ac1/grid    60.0 aac
input limit
DOWN  INC  DEC  PORT
```

The **AC1/GRID INPUT LIMIT** sets the maximum amount of current the FX allows to be drawn from the AC source. When the AC input current limit is reached, the power draw of the battery charger is backed off to prevent overloading the AC source. If the AC loads exceed this limit, the FX will give a warning and start blinking the red "ERROR" LED. This setting has a range between 5.0 aac and 60.0 aac in 1.0 aac increments.

```
ADV/FX/GRID-----P00
ac1/grid    6 cycles
transfer delay
DOWN  INC  DEC  PORT
```

The **AC1/GRID TRANSFER DELAY** is the amount of time that the AC input will remain connected to the AC source when the AC input voltage drops below the AC1/GRID lower limit setting. Once the AC voltage has risen above the AC1/GRID lower limit setting for the AC INPUT CONNECT DELAY time period, the AC source will be reconnected. This setting has a range between 0 cycles and 240 cycles in 1 cycle increments.

```
ADV/FX/GRID-----
GRID programming
completed
TOP  ADV  MAIN
```

Selecting TOP returns the user to the top of the ADV/FX/GRID menu section. Selecting ADV returns you to the advanced screen to allow selection of another product connected to the MATE. Selecting MAIN returns the display to the MAIN screen.

## GENERATOR MENU

The **GEN** (generator) category of the advanced menu section allows for adjustment of the AC input voltage window and time delays to match the characteristics of the AC source if that AC source is a generator. This setting can be found in the SETUP/FX/INPUT menu. All OutBack Power System FX's other than the "Grid-Tie" FX's have a default of GEN (generator) as the AC source.

```

ADV-----
choose product:

FX                MATE
    
```

Once the password has been correctly entered, the ADV - CHOOSE PRODUCT is displayed. Selecting **<FX>** allows adjustment of the FX's advanced programming.

```

ADV/FX/PAGE1-----
choose category:

ADV  INV  CHGR  PG2
    
```

Selecting **<PG2>** advances the user to the second page of the advanced menu.

```

ADV/FX/PAGE2-----
choose category:

PG1  GRID  GEN  PG3
    
```

Selecting **<GEN>** allows adjustment of the AC input set points and operation.

```

ADV/FX/GEN-----P00
ac input    00.5 min
connect delay
DOWN  INC  DEC  PORT
    
```

The **AC INPUT CONNECT DELAY** set point adjusts the time period of when the FX sees an acceptable AC source to when it connects the AC loads to that source. This is useful to allow a generator to warm up. This setting has a range between 0.2 minutes to 15 minutes in 0.1 minute increments.

```

ADV/FX/GEN-----P00
ac2/gen     108 vac
lower limit
DOWN  INC  DEC  PORT
    
```

The **AC2/GEN LOWER LIMIT** set point allows adjustment of the minimum voltage that the AC source is allowed to be in order for the FX to connect to that source. The FX will back off the charger if the AC source is at this lower limit. If the AC source falls below this limit, the FX will disconnect from the AC source until it is above this value. This setting has a range between 70 vac and 110 vac in 1 vac increments.

```

ADV/FX/GEN-----P00
ac2/gen     140 vac
upper limit
DOWN  INC  DEC  PORT
    
```

The **AC2/GEN UPPER LIMIT** set point allows adjustment of the maximum voltage that the AC source is allowed to be in order for the FX to connect to that source. If the AC source exceeds this value, the FX will disconnect from the AC source until it is below this value. This setting has a range between 130 vac and 150 vac in 1 vac increments.

```

ADV/FX/GEN-----P00
ac2/gen     30.0 aac
input limit
DOWN  INC  DEC  PORT
    
```

The **AC2/GEN INPUT LIMIT** sets the maximum amount of current the FX allows to be drawn from the AC source. When the AC input current limit is reached, the power draw of the battery charger is backed off to prevent overloading the AC source. If the AC loads exceed this limit, the FX will give a warning and start blinking the red "ERROR" LED. This setting has a range between 5.0 aac and 60.0 aac in 1.0 aac increments.

```

ADV/FX/GEN-----P00
ac2/gen     60 cycles
transfer delay
DOWN  INC  DEC  PORT
    
```

The **AC2/GEN TRANSFER DELAY** is the amount of time that the AC input will remain connected to the AC source when the AC input voltage drops below the AC2/GEN lower limit setting. Once the AC voltage has risen above the AC2/GEN lower limit setting for the AC INPUT CONNECT DELAY time period, the AC source will be reconnected. This setting has a range between 0 cycles and 240cycles in 1 cycle increments.

```

ADV/FX/GEN-----P00
ac2/gen     OFF
support
DOWN  OFF  ON  PORT
    
```

The **AC2/GEN SUPPORT** setting is not operational at this time.

```

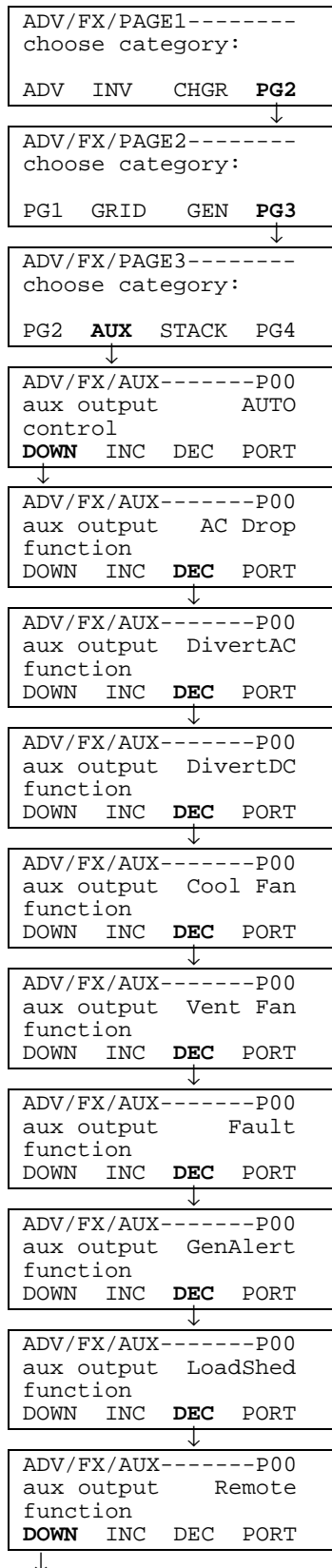
ADV/FX/GEN-----
GEN programming
completed
TOP  ADV  MAIN
    
```

Selecting TOP returns the user to the top of the ADV/FX/GEN menu section. Selecting ADV returns you to the advanced screen to allow selection of another product connected to the MATE. Selecting MAIN returns the display to the MAIN screen.



**AUXILIARY MENU**

The **AUX** (auxiliary) section can be used to control external AC or DC loads, signal a generator start system, send a fault alarm signal, or to run a fan. The AUX output provides a 12 vdc, 0.7 adc max signal on the AUX terminals located in the AC wiring compartment.



Once the password has been correctly entered, the ADV - CHOOSE CATEGORY: screen is displayed. Selecting **<PG2>** shows a second screen of categories.

Selecting **<PG3>** shows a third screen of categories.

Selecting **<AUX>** allows adjustment of the auxiliary output set points and operation. The **AUX OUTPUT CONTROL** screen allows selection of the mode of the AUX output. Selecting INC or DEC changes the mode between OFF, AUTO, and ON. Selecting OFF disables the AUX output from operating. Selecting ON forces the AUX output to be ON regardless of the function selected. Selecting AUTO in the AUX OUTPUT CONTROL screen allows the AUX output to automatically perform the function that is selected in the AUX OUTPUT FUNCTION screens below.

Pressing **<DOWN>** allows the selection of the **AUX OUTPUT FUNCTION**. There are nine functions in this section. The default setting is "Cool Fan" which is set to run a Turbo Kit without any further programming. The function at the top of the menu is "AC Drop". The user must press **<INC>** three times in order to get to the top of the list of functions. From the top, one can press **<DEC>** to cycle through the whole list of auxiliary functions. **See the next page to adjust the set points for the functions that have set points.**

Selecting **AC DROP** enables the AUX output when an AC source is connected to the FX. When the AC source ceases (due to a power outage, or a generator quitting) the Aux output will be deactivated. This allows the user to attach an indicator to the AUX output to show the user when an AC source is connected.

Selecting **DIVERT AC** or **DIVERT DC** enables the AUX output to function as a diversion controller. This can be used to send excess power from a renewable energy source to a load. This can allow control of sources such as wind turbines or hydro-generators. Two choices of DIVERT are provided – 'DivertDC' and 'DivertAC'. 'DivertDC' is used to divert power to DC loads and 'DivertAC' is used to divert power to AC loads. The only difference is that the 'DivertAC' setting will turn off the AUX output if the inverter is overloaded. These settings have two set point screens (see following page).

Selecting **COOLFAN** (default) enables the AUX output to function as a thermostatically operated ventilation system controller. When the FX approaches an over temperature condition, the AUX output will be energized. This can be used to power a small 12 vdc brushless "muffin" type fan, the Turbo Kit, or can be used to control a larger cooling fan via a 12 vdc coil relay.

Selecting **VENTFAN** enables the AUX output to function as an automatic battery ventilation system controller. The AUX output can provide 0.7 amps of power for connection to a 12 vdc brushless "muffin" type fan. The fan will be automatically turned on when the voltage exceeds the VENTFAN ON voltage set point. The fan can be set to operate intermittently by adjusting the VENTFAN OFF TIME PERIOD. This setting has two set point screens (see following page).

Selecting **FAULT** enables the AUX output to function as an alarm output. When the FX enters any of the error conditions, the AUX output is energized. This can be used to send an alarm signal via radio, pager or telephone dialer. It also can be used to log error conditions by using it to trigger an event recording device.

Selecting **GENALERT** enables the AUX output to function as a simple voltage controlled generator start signal. 'GenAlert' can be used to "alert" the system user to start the generator due to the battery voltage being low. GenAlert can also be used to connect a 2-wire type generator through a 12 volt DC relay. Time delays for ON and OFF are adjustable. Using 'Advanced Generator Start' (AGS, a different generator start system) will override this and any AUX function that is programmed on the port that AGS is set up on. GenAlert has four set point screens (see following page).

Selecting **LOADSHED** enables the AUX output to function as a load management system. When the battery voltage drops below the LOAD DISCONNECT set point for more than 3 seconds, the AUX output is energized. Connecting a normally closed (NC) relay to the circuitry of non-vital loads will disengage them with this function. LOADSHED will also occur when the FX approaches an over-temperature condition or when the AC output voltage drops below 105 vac for more than 3 seconds. There is a 3-minute fixed delay before the AUX output is de-energized. This setting has one set point screen (see following page).

Selecting **REMOTE** enables the AUX output to be controlled by the MATE or a PC computer connected to the MATE PC communication port. This function is currently not operational. It will be operational in the future.

Press **<DOWN>** after selecting the AUX OUTPUT FUNCTION of your choice (it should be showing on the screen). The AUX menu section is continued on the following page.

## AUXILIARY MENU (CONTINUED)

This page contains to settings for some of the functions that can be chosen in the AUX OUTPUT FUNCTION screen described on the previous page. The functions that do not have setting perform automatically as described on the previous page. There are voltage and time period settings for 'GenAlert', 'LoadShed', 'VentFan', and 'Diversion'.

The following displays allow the adjustment of the particular AUX OUTPUT FUNCTION that was selected on the previous screen in the AUX menu section, if applicable.

```
ADV/FX/AUX-----P00
genalert    11.0 vdc
on setpoint
DOWN INC DEC PORT
```



```
ADV/FX/AUX-----P00
genalert    4 min
on delay
DOWN INC DEC PORT
```



```
ADV/FX/AUX-----P00
genalert    14.0 vdc
off setpoint
DOWN INC DEC PORT
```



```
ADV/FX/AUX-----P00
genalert    9 min
off delay
DOWN INC DEC PORT
```



```
ADV/FX/AUX-----P00
loadshed    11.0 vdc
off setpoint
DOWN INC DEC PORT
```



```
ADV/FX/AUX-----P00
ventfan     13.0 vdc
on setpoint
DOWN INC DEC PORT
```



```
ADV/FX/AUX-----P00
ventfan off  5 min
period
DOWN INC DEC PORT
```



```
ADV/FX/AUX-----P00
diversion   14.6 vdc
on setpoint
DOWN INC DEC PORT
```



```
ADV/FX/AUX-----P00
diversion   30 sec
off delay
DOWN INC DEC PORT
```



```
ADV/FX/AUX-----
aux output
setup completed
TOP ADV MAIN
```

The **GENALERT ON SET POINT** is the battery voltage at which the FX will start counting down the 'GenAlert On Delay' (see next screen). After the 'GenAlert On Delay' time has been reached, the AUX output is energized and turns the generator on through a 12 vdc relay. This screen is applicable if the AUX OUTPUT FUNCTION has been set to GENALERT. This setting has a range between 10.0 vdc and 14.0 vdc in 0.1 vdc increments.

The **GENALERT ON DELAY** is the amount of time that the battery voltage must remain below the GENALERT ON SET POINT voltage for the AUX output to become energized. This setting is provided to allow for short periods of heavy load usage. This screen is applicable if the AUX OUTPUT FUNCTION has been set to GENALERT. This setting has a range between 0 minutes and 240 minutes in 1 minute increments.

The **GENALERT OFF SET POINT** is the battery voltage at which the FX will start counting down the 'GenAlert Off Delay' (see next screen). After the 'GenAlert Off Delay' time has been reached, the AUX output is de-energized and turns the generator off. This screen is applicable if the AUX OUTPUT FUNCTION has been set to GENALERT. This setting has a range between 12.0 vdc and 18.0 vdc in 0.1 vdc increments.

The **GENALERT OFF DELAY** is the amount of time that the battery voltage must remain above the GENALERT OFF SET POINT voltage for the AUX output to become de-energized. This setting is provided to allow for smaller battery banks that may attain higher voltages more quickly. This screen is applicable if the AUX OUTPUT FUNCTION has been set to GENALERT. This setting has a range between 0 minutes and 240 minutes in 1 minute increments.

The **LOADSHED OFF SETPOINT** is the battery voltage at which the AUX output is energized to reduce the load on the FX system. Once the battery voltage has dropped below this setting for 3 seconds the AUX output will provide 12 vdc to power a DC coil relay to disconnect an AC load. Once the LOADSHED function has been triggered it will remain on for a minimum of 3 minutes. This screen is applicable if the AUX OUTPUT FUNCTION has been set to LOADSHED. This setting has a range between 10.0 vdc and 14.0 vdc in 0.1 vdc increments.

The **VENTFAN ON SETPOINT** is the battery voltage at which the AUX output is energized to vent a battery enclosure to prevent hydrogen gas from accumulating. When the battery voltage rises to this setting's value the AUX output is activated to power a 12 vdc fan. This screen is applicable if the AUX OUTPUT FUNCTION has been set to VENTFAN. This setting has a range between 10.0 vdc and 16.0 vdc in 0.1 vdc increments.

The **VENTFAN OFF PERIOD** set point can be used to allow for intermittent operation of the battery enclosure ventilation system. Setting the time period to 5 minutes will operate the fan at a 50% duty cycle as the "on" time period is fixed at 5 minutes. Setting the VENTFAN OFF PERIOD to zero will keep the fan on continuously when the battery voltage exceeds the VENTFAN ON voltage set point. This screen is applicable if the AUX OUTPUT FUNCTION has been set to VENTFAN. This setting has a range between 0 minutes and 30 minutes in 1 minute increments.

The **DIVERSION ON SETPOINT** enables the AUX output to function as a diversion controller. This can be used to send excess power from a renewable energy source to a load. When the battery voltage reaches this set point, the auxiliary output will be activated. This screen is applicable if the AUX OUTPUT FUNCTION has been set to either DIVERT AC or DIVERT DC. This setting has a range between 12.0 vdc and 16.0 vdc in 0.1 vdc increments.

The **DIVERSION OFF DELAY** is the amount of time that the AUX output will continue to be energized after the battery voltage falls below the DIVERSION ON SETPOINT voltage. In cases where the battery voltage is hovering around the DIVERSION ON SETPOINT voltage, the AUX output won't flicker. This screen is applicable if the AUX OUTPUT FUNCTION has been set to either DIVERT AC or DIVERT DC. This setting has a range between 0 seconds and 240 seconds in 1 second increments.

Selecting TOP returns the user to the top of the ADV/FX/AUX menu section. Selecting ADV returns you to the advanced screen to allow selection of another product connected to the MATE. Selecting MAIN returns the display to the MAIN screen.

STACKING MENU

The **STACK** (stacking) section is used to program the stacking of the FX's. An explanation of stacking can be found in the STACKING INFORMATION and STACKING INSTRUCTIONS sections of this manual. The FX's can be connected in series, parallel or 3-phase for higher voltage and/or higher power. There are four types of stacking available; 'Classic Stacking', 'OutBack Parallel Stacking', 'OutBack Series Stacking' and '3-Phase Stacking'. The programming of the "master" and "slave" units must be completed with the inverters OFF in order to prevent possible problems.

```

ADV/FX/PAGE1-----
choose category:
ADV  INV  CHGR  PG2
    
```

Once the password has been correctly entered, the ADV - CHOOSE CATEGORY: screen is displayed. Selecting <PG2> shows a second screen of categories.

```

ADV/FX/PAGE2-----
choose category:
PG1  GRID  GEN  PG3
    
```

Selecting <PG3> shows a third screen of categories.

```

ADV/FX/PAGE3-----
choose category:
PG2  AUX  STACK  PG4
    
```

Selecting <STACK> allows adjustment of the stacking set points and operation.

```

ADV/FX/STACK-----P00
Stack 1-2ph Master
phase
DOWN  INC  DEC  PORT
    
```

The **STACK PHASE** screen sets the hierarchy of the FX's. If the system is to be stacked, a HUB must be included and the FX that is to be the MASTER must be plugged into port 1 of the HUB. The default for every FX is '1-2ph Master'. Pressing PORT will select the next port that a FX is plugged into. When the port for the FX has been chosen, press INC until the proper master or slave type appears (1-2ph Master, Classic Slave, OB Slave L1, OB Slave L2, 3ph Master, or 3ph Slave).

```

ADV/FX/STACK-----P00
power save level  0
master adjust only
DOWN  INC  DEC  PORT
    
```

The **POWER SAVE LEVEL MASTER ADJUST ONLY** is used to set the number of 'slaves' that will remain 'On' when the system is operating at light load levels. The value corresponds to the rank of the SLAVE. For example, setting this value to 2 allows all SLAVE's with POWER SAVE LEVEL SLAVE ADJUST ONLY (see next screen) values of 2 or less to stay on at all times. This setting is for "OutBack Stacking" methods only (system with "OB Slave L1" or "OB Slave L2" slaves).

```

ADV/FX/STACK-----P00
power save level  1
slave adjust only
DOWN  INC  DEC  PORT
    
```

The **POWER SAVE LEVEL SLAVE ADJUST ONLY** is used to set a slave inverter's priority for operation when the total FX system is operating at medium to heavy loads. By setting each of the slaves to a different number you can control the sequence that the slave inverters are turned on by the master inverter. This setting is necessary for "OutBack Stacking" methods.

```

ADV/FX/STACK-----
stacking setup
completed
TOP  ADV  MAIN
    
```

Selecting TOP returns the user to the top of the ADV/FX/STACK menu section. Selecting ADV returns you to the advanced screen to allow selection of another product connected to the MATE. Selecting MAIN returns the display to the MAIN screen.

## SELL MENU

The **SELL** menu is used to set the functions that control the process of selling power back to the utility grid. This menu only pertains to Grid-Tied FX's. These functions include setting the voltage at which the FX sells back to the utility grid, setting the window in which the Grid-Tie function operates, and to enable or disable the Grid-Tie function. The default values enable the FX to sell back to the utility grid after the FX has completed a charge cycle. To disable this charge cycle, press the **<AC IN>** "hot" button four times, press **<BULK>**, press **<STOP>** and then press **<OK>**. The FX waits 5 minutes after it has accepted the utility grid as an AC source and must be above the "sell RE volts" (found in this menu) to start selling.

```
ADV/FX/PAGE1-----
choose category:
ADV  INV  CHGR  PG2
```

Once the password has been correctly entered, the ADV - CHOOSE CATEGORY: screen is displayed. Selecting **<PG2>** shows a second screen of categories.

```
ADV/FX/PAGE2-----
choose category:
PG1  GRID  GEN  PG3
```

Selecting **<PG3>** shows a third screen of categories.

```
ADV/FX/PAGE3-----
choose category:
PG2  AUX  STACK  PG4
```

Selecting **<PG4>** shows a fourth screen of categories.

```
ADV/FX/PAGE4-----
choose category:
PG3  SELL  CAL  MAIN
```

Selecting **<SELL>** allows adjustment of the Grid-tie and selling set points and operation.

```
ADV/FX/SELL-----P00
sell re      12.8vdc
volts
DOWN  INC  DEC  PORT
```

The **SELL RE VOLTS** (RE = Renewable Energy) screen allows the user to set the voltage at which they would like to sell battery power back to the utility grid. If the battery voltage is above the voltage shown on this screen and the FX isn't charging then the FX will sell power back to the utility grid. This setting has a range between 10.0 vdc and 15.0 vdc in 0.1vdc increments.

```
ADV/FX/SELL-----P00
grid tie    IEEE
window
DOWN  IEEE  USER  PORT
```

The **GRID TIE WINDOW** screen controls the voltage and frequency windows that the grid-tie function operates in. If the FX repeatedly disconnects from the utility grid this value may need to be changed. This function **should not**, I repeat, **should not** be changed without consulting OutBack Power Systems first.

```
ADV/FX/SELL-----P00
grid tie    GridTie
authority
DOWN  INC  DEC  PORT
```

The **GRID TIE AUTHORITY** screen allows the user to turn on or off the selling function of the FX. When the screen displays "GridTie" (default), the FX will sell power under the correct conditions. Pressing DEC will change "GridTie" to "No Sell" and the selling function will be disabled. Pressing INC will change the display back from "No Sell" to "GridTie".

```
ADV/FX/SELL-----
selling setup
completed
TOP  ADV  MAIN
```

Selecting TOP returns the user to the top of the ADV/FX/SELL menu section. Selecting ADV returns you to the advanced screen to allow selection of another product connected to the MATE. Selecting MAIN returns the display to the MAIN screen.

**CALIBRATION MENU**

The **CAL** (calibration) section is used in the factory or field to make fine adjustments in the operation of the FX. It is particularly useful when multiple FX's are connected together in the different stacking configurations to maximize the performance of the FX's.

In most cases, the user will not need to adjust these settings from the factory default values.

```

ADV/FX/PAGE1-----
choose category:
ADV  INV  CHGR  PG2
    
```

Once the password has been correctly entered, the ADV - CHOOSE CATEGORY: screen is displayed. Selecting <PG2> shows a second screen of categories.

```

ADV/FX/PAGE2-----
choose category:
PG1  GRID  GEN  PG3
    
```

Selecting <PG3> shows a third screen of categories.

```

ADV/FX/PAGE3-----
choose category:
PG2  AUX  STACK  PG4
    
```

Selecting <PG4> shows a fourth screen of categories.

```

ADV/FX/PAGE4-----
choose category:
PG3  SELL  CAL  MAIN
    
```

Selecting <CAL> allows calibration of the AC input, AC output, and battery voltage set points.

```

ADV/FX/CALIBRATE-P00
vac input      120 vac
adjustment
DOWN  INC  DEC  PORT
    
```

The **VAC INPUT ADJUSTMENT** allows calibration of the AC input voltage. If the AC source is measured and is different than the value read from the MATE, the user can adjust it to match the measured value. This value can be raised by pressing the INC button. Conversely, this value can be lowered by pressing the DEC button. The value can be raised or lowered up to 2 vac.

```

ADV/FX/CALIBRATE-P00
vac output     120 vac
adjustment
DOWN  INC  DEC  PORT
    
```

The **VAC OUTPUT ADJUSTMENT** allows calibration of the AC output voltage. If the AC output is measured and is different than the value read from the MATE, the user can adjust the reading to match the measured value. This value can be raised up to 2 vac by pressing the INC button and lowered up to 2 vac by pressing the DEC button. NOTE: This only affects the MATE's voltage display - See page 51 [ADJ. OUTPUT VOLTAGE] for actual adjustment of inverter VAC output.

```

ADV/FX/CALIBRATE-P00
battery vdc 12.8 vdc
adjustment
DOWN  INC  DEC  PORT
    
```

The **BATTERY VDC ADJUSTMENT** allows calibration of the battery voltage. If the battery voltage is measured and is different than the value read from the MATE, the user can adjust it to match the measured value. This value can be raised by pressing the INC button. Conversely, this value can be lowered by pressing the DEC button. The value can be raised or lowered up to 0.2 vdc for 12V battery system, 0.4V for 24V battery systems, and 0.8V for 48V battery systems.

```

ADV/FX/CALIBRATION--
calibration setup
completed
TOP  ADV  MAIN
    
```

Selecting TOP returns the user to the top of the ADV/FX/CALIBRATION menu section. Selecting ADV returns you to the advanced screen to allow selection of another product connected to the MATE. Selecting MAIN returns the display to the MAIN screen.

**END OF ADVANCED MENU SYSTEM**

## **WIRE SIZES**

---

The following chart contains information on wire sizes, the DC resistance of the wires and the corresponding diameters and areas of these wires. This information can be used to calculate the voltage drop of the wires or to find an equivalent wire size.

<b>SIZE (AWG)</b>	<b>DC Resistance in Ohms (1000 feet)</b>	<b>CROSS-SECTIONAL AREA</b>		<b>APPROXIMATE DIAMETER</b>	
		<b>INCHES</b>	<b>MILLIMETERS</b>	<b>INCHES</b>	<b>MILLIMETERS</b>
<b>14</b>	<b>3.14</b>	<b>.0032</b>	<b>2.08</b>	<b>.078</b>	<b>1.98</b>
<b>12</b>	<b>1.98</b>	<b>.0051</b>	<b>3.31</b>	<b>.101</b>	<b>2.57</b>
<b>10</b>	<b>1.24</b>	<b>.0082</b>	<b>5.26</b>	<b>.126</b>	<b>3.20</b>
<b>8</b>	<b>0.78</b>	<b>.0130</b>	<b>8.37</b>	<b>.162</b>	<b>4.11</b>
<b>6</b>	<b>0.50</b>	<b>.0206</b>	<b>13.30</b>	<b>.215</b>	<b>5.46</b>
<b>4</b>	<b>0.31</b>	<b>.0328</b>	<b>21.15</b>	<b>.269</b>	<b>6.83</b>
<b>2</b>	<b>0.19</b>	<b>.0521</b>	<b>33.62</b>	<b>.337</b>	<b>8.56</b>
<b>1</b>	<b>0.15</b>	<b>.0657</b>	<b>42.41</b>	<b>.376</b>	<b>9.55</b>
<b>1/0</b>	<b>0.12</b>	<b>.0829</b>	<b>53.50</b>	<b>.423</b>	<b>10.74</b>
<b>2/0</b>	<b>0.10</b>	<b>.1045</b>	<b>67.43</b>	<b>.508</b>	<b>12.90</b>
<b>3/0</b>	<b>0.08</b>	<b>.1318</b>	<b>85.01</b>	<b>.576</b>	<b>14.63</b>
<b>4/0</b>	<b>0.06</b>	<b>.1662</b>	<b>107.20</b>	<b>.645</b>	<b>16.38</b>

## OutBack Power Systems

# Two Year Limited Warranty

OutBack Power Systems Inc. warrants that the products it manufactures will be free from defects in materials and workmanship for a period of two (2) years subject to the conditions set forth below.

The limited warranty is extended to the original user and is transferable. The limited warranty term begins on the date of invoice to the original user of the product. The limited warranty does not apply to any product or part thereof damaged by a) alteration or disassembly, b) accident or abuse, c) corrosion, d) lightning, e) reverse polarity, f) repair or service provided by an unauthorized repair facility, g) operation or installation contrary to instructions pertaining to the product.

OutBack Power Systems' liability for any defective product or any part thereof shall be limited to the repair or replacement of the product, at OutBack Power Systems' discretion. OutBack Power Systems does not warrant or guarantee the workmanship performed by any person or firm installing its products.

THIS LIMITED WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER RIGHTS THAT VARY FROM STATE TO STATE (OR JURISDICTION TO JURISDICTION). OUTBACK POWER SYSTEMS' RESPONSIBILITY FOR MALFUNCTIONS AND DEFECTS IN HARDWARE IS LIMITED TO REPAIR AND REPLACEMENT AS SET FORTH IN THIS LIMITED WARRANTY STATEMENT. ALL EXPRESS AND IMPLIED WARRANTIES FOR THE PRODUCT, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF AND CONDITIONS OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED IN DURATION TO THE LIMITED WARRANTY PERIOD SET FORTH ABOVE AND NO WARRANTIES, WHETHER EXPRESS OR IMPLIED, WILL APPLY AFTER SUCH PERIOD. SOME STATES (OR JURISDICTIONS) DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATION MAY NOT APPLY TO YOU.

OUTBACK POWER SYSTEMS DOES NOT ACCEPT LIABILITY BEYOND THE REMEDIES SET FORTH IN THIS LIMITED WARRANTY STATEMENT OR LIABILITY FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION ANY LIABILITY FOR PRODUCTS NOT BEING AVAILABLE FOR USE. SOME STATES (OR JURISDICTIONS) DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE EXCLUSION OR LIMITATION MAY NOT APPLY TO YOU.

During the two year period beginning on the invoice date, OutBack Power Systems will repair or replace products covered under this limited warranty that are returned to OutBack Power Systems' facility or to an OutBack Power Systems authorized repair facility, or that are repaired on site by an OutBack Power Systems authorized repair technician. To request limited warranty service, you must contact OutBack Power Systems at 360-435-6030 within the limited warranty period. If limited warranty service is required, OutBack Power Systems will issue a Return Material Authorization (RMA) Number. Mark the outside of the package with the RMA number and include a copy of the purchase invoice in the package. You must ship the products back to OutBack Power Systems in their original or equivalent packaging, prepay shipping charges, and insure the shipment or accept the risk of loss or damage during shipment. OutBack Power Systems will ship the repaired or replacement products to you freight prepaid if you use an address in the continental United States, where applicable. Shipments to other locations will be made freight collect.





Your purchase of an OutBack Power Systems product is an important investment. Registering your products will help us maintain the standard of excellence you expect from us in terms of performance, quality and reliability.

Please take a moment to register and provide us with some important information.

Name: \_\_\_\_\_

Address: \_\_\_\_\_

City, State, Zip Code: \_\_\_\_\_

Country: \_\_\_\_\_

Telephone Number: \_\_\_\_\_

E-mail: \_\_\_\_\_

Sold by: \_\_\_\_\_

Installer: \_\_\_\_\_

Purchase Date: \_\_\_\_\_

Model Number: \_\_\_\_\_

Serial Number: \_\_\_\_\_

Circle all that apply:

Off-Grid Installation

Residential Installation

North America Location

Utility Connected Installation

Commercial Installation

Other \_\_\_\_\_

## Extended Warranty Application

OutBack Power Systems offers an optional three year extension to the standard two year limited warranty. Purchase of extended warranty coverage is available on products listed below provided conditions shown are met. Extended warranty coverage must be purchased within 90 days of the original sale of the product covered.

PRODUCT	REQUIRED SURGE PROTECTION	EXTENDED WARRANTY COST
Any FX Series Inverter/Charger	AC Input; AC Output, DC Input	\$300.00
MX60	DC Input; DC Output	\$100.00
MATE	NA	\$50.00
HUB 4	NA	\$35.00
HUB 10	NA	\$50.00

<u>Product Covered</u>	<u>Serial Number</u>	<u>Quantity</u>	<u>Extended Warranty Cost</u>
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
<b>Total</b>			_____

Send check or money order payable to OutBack Power Systems. Include a completed copy of this application and send to:

OutBack Power Systems  
Extended Warranty Program  
19009 62nd Ave NE  
Arlington, WA 98223 USA